Draft Quarterly Whooping Crane Monitoring Report
Necedah National Wildlife Refuge

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Purpose: The purpose of this summary is to report endangered species management activities, specific to whooping cranes, that were conducted on Necedah National Wildlife Refuge between April and June, 2011. These activities are covered by a Biological Opinion Section 7, Endangered Species Act Permit, dated March 21, 2002. This report also covers some activities that were conducted off of Necedah National Wildlife Refuge at the request of partner agencies/organizations.

Methods: Whooping cranes on Necedah National Wildlife Refuge were monitored following methods outlined in the Draft Nesting Whooping Crane Management Plan: Necedah National Wildlife Refuge, dated January 10, 2011. Whooping crane chicks were monitored following methods outlined in the Draft Chick Monitoring Plan for the Reintroduced Eastern Migratory Whooping Crane Population dated, April 30, 2010. Both plans were reviewed by the National Wildlife Refuge System, Midwest Region, Biological Resource Division and received external peer review per the Department of Interior's Policy on Integrity and Scientific and Scholarly Activities (305 DM 3). The draft plans were also reviewed by partner agencies/organizations.

A summary of the methods outlined in those plans is provided here to assist with reading of this report. Readers are encouraged to refer to the original plans for more details. Whooping crane nests were located with the assistance of radio telemetry, when possible, through ground and aerial reconnaissance. Aerial reconnaissance was completed by partner agencies/organizations. To assist with monitoring, both nest cameras and DVRs/surveillance cameras are used. The nest cameras were Reconyx Hyperfires. These cameras have the advantages of being fully programmable and having 30 day battery life. These cameras have the disadvantage of taking only still images. DVR/surveillance cameras are also programmable and have the advantage of providing continuous video. They have the disadvantage or requiring battery/video card replacement every 2 to 3 days.

Whooping crane chicks were monitored twice daily for their first month of life. After chicks reach one month of age, monitoring is reduced to one check per day. During chick monitoring, observers look for the chick if the chick is visible. As the chicks are small and the wetland vegetation is often tall, the crane chicks are not often visible. In these cases, we observed the parents to determine if their behaviors were consistent with them feeding or otherwise tending to a chick.

Necedah National Wildlife Refuge staff monitored biting insect populations in two ways: 1) with Center for Disease Control Traps and 2) by making collections at whooping crane nests. Samples at nests were obtained using three different methods: a) using a whooping crane decoy with a sticky glueboard placed in the decoy's head, b) by collecting biting insects entrapped in whooping crane egg or egg shell fragments (this includes both damaged and hatched eggs), and c) by taking a high resolution image of the nest.

RESULTS

Whooping Crane Nesting Pair Arrival: The first nesting pair of whooping cranes arrived back at Necedah National Wildlife Refuge on or about March 11 (see Figure 1 and Table 1). This pair (5-05/15-04) had adopted a yearling whooping crane and returned to their nesting territory with the yearling bird. The latest arrival data for a nesting whooping crane pair was on or about April 13. The male of this pair arrived on or about March 29. The female however did not return until April 13. The average date of return for nesting pairs was March 21 (±1.9 days; SE). See Table 1 for complete list of return dates.

Whooping Crane Nests: Seventeen whooping crane nests that contained at least one egg were built on Necedah National Wildlife Refuge in 2011 (See Figure2). These nests were constructed by 15 different pairs. Necedah National Wildlife Refuge staff monitored all of these nests and assisted partner agency/organization staff with monitoring efforts for four additional whooping crane nests. The first whooping crane nest of the season was initiated on April 6, 2011 (see Figure 3). The last whooping crane nest of the season was initiated on May 18, 2011. The first whooping crane nest failure of the year occurred April 23, 2011 while the first whooping crane hatch of the year occurred on May 9. In total, four whooping crane pairs on Necedah National Wildlife Refuge hatched at least one chick in 2011; two on May 9, one on May 11, and one on May 16. In total, 13 of the whooping crane nests constructed on Necedah National Wildlife Refuge were not incubated full-term (30 days) in 2011. The last nest failure occurred on May 28, 2011. For complete monitoring details for whooping crane nests monitored by Necedah National Wildlife Refuge staff in 2011, see Appendices 1 through 18.

Whooping Crane Chick Monitoring: Four whooping crane chicks were hatched on Necedah National Wildlife Refuge in 2011. None of these chicks fledged. Minimum and maximum lifespan for the crane chicks were two and 45 days respectively. We were able to locate just one dead whooping crane chick in 2011. A necropsy conducted by staff from the National Wildlife Health Lab indicated that the mortality was consistent with a predation event. The carcass however was not consumed indicating that the parents may have warded off a predator after the mortality had already occurred. The first whooping crane chick mortality occurred on May 9 or 10, 2011. The last whooping crane chick mortality event on Necedah National Wildlife Refuge occurred on June 30 or July 1, 2011. Whooping crane chicks moved an average distance of 300.0 meters between locations. Generally, the distance moved between locations increased as the chicks aged (Figure 4). For complete monitoring details for whooping crane chicks monitored by Necedah National Wildlife Refuge staff in 2011, see Appendices 19 through 22.

Biting Insects: Samples obtained with the Center for Disease Control Traps, decoy/glueboards, and those entrapped in eggs/egg fragments were sent to Clemson University and the results are pending. As of this writing, we have information for the number of biting insect collected on the decoys/glueboards as well as the number of biting insects seen on the high resolution images. The first black flies of the season detected with decoys/glueboards were collected on April 25 (see Table 2). The last glueboard sample of the season was collected on May 28 and it also contained black flies. The maximum and minimum glueboard samples were 166 and 0 respectively. The maximum sample was collected on May 4 while samples containing 0 black flies were collected on April 30 and May 5, 15, and

22. The nest producing the highest glueboard sample also produced the highest number of black flies (2,631) captured on a nest image. This was the third highest count ever resulting from a high resolution nest image. One image from 2009 (a nest on Necedah National Wildlife Refuge) resulted in 4,183 black flies and one nest from 2010 (in Wood County, not on Necedah National Wildlife Refuge) resulted in 9,153 black flies.

Information Advances Made in 2011: The Necedah National Wildlife Refuge was able to make several advances in the understanding of whooping crane nest ecology in 2011. Some of those advances follow:

1) **Black flies at successful whooping crane nests**: We were able to visit four whooping crane nests shortly after the egg(s) hatched. This was possible because the crane families nested in areas with thick vegetation and they left the nest area shortly after hatch. Our glueboard samples at the successful nests resulted in collections of 0, 1, 50 and 56 black flies. Images of the nests resulted in counts of 0, 13, 25, and 130 black flies counted (see appendices 2, 9, 10, and 17). Samples of black flies entrapped in egg remnants at these nests were collected and sent to Clemson University. Those results are pending as of this writing. All of this evidence indicates that the presence of black flies at whooping crane nests does not preclude successful nesting.
2) **Black fly population fluctuation:** In past years we have noted that black fly numbers varied markedly at failed whooping crane nests; ranging from 0 to more than 9,000. In 2011, we observed extreme variability in black fly numbers at failed crane nests but also found that the fluctuation can occur within the same day. One nest was found abandoned at 1000 on May 9 and contained one egg with a puncture wound on the top of the egg. Drowned black flies were observed in the egg and black flies were observed flying around the nest. Samples of drowned flies collected in eggs have typically resulted in several hundred to more than 1,500 individual black flies. This same nest was revisited at 1700 to collect the damaged egg, collect a decoy/glueboard sample, and take a high resolution image of the nest. At 1700, the egg was gone, the glueboard produced one black fly and the nest image (taken after the decoy sample was collected) resulted in 0 black flies counted (see appendix 8).
3) **Daily nest survival**: Whooping crane daily nest survival declined in 2011. Although the same number of pairs (6) were successful in terms of full term incubation, the percent of full term incubations declined between 2010 (35.3 %) and 2011 (27.3 %). As nest fate is used to calculate daily nest survival, it is not surprising that it declined in 2011 (see Figure 5). Two of the six whooping crane nests incubated full-term in 2011 were outside the area (10 km) assumed to be affected by a larvicide treatment of the Yellow River (see Figure 7).
4) **Direct Autumn Release nest performance**: As was the case in 2010, whooping crane pairs with a female raised in the Direct Autumn Release program had higher daily nest survival than pairs that did not contain a female from this program (see Figure 6). These results are encouraging because all of these pairs are relatively inexperienced (maximum of 2 nest attempts for a pair) and as a result, performance of this group should continue to improve relative to the population baseline.
5) **Black flies in the larvicide treatment zone**: A larvicide treatment of the Yellow River aimed at reducing black flies within a 10 km distance of the river was applied in 2011 (see Figure 7). We

were able to increase our black fly sampling at whooping crane nests within the 2011 treatment zone. Results of that sampling indicate that black fly abundance at whooping crane nests in 2011 inside the 10 km treatment zone was consistent with results from previous years (see Figures 8, 9, 10, 11, 12, 13, 14 and 15). Based on a small sample (n=3), daily nest survival and probability of full term incubation was higher for nests outside of the treatment area (see figure 16).

6) **Whooping Crane Nest Attentiveness**: In 2011, we found that whooping crane eggs were frequently left unattended at nests that were incubated full-term and by those that were eventually abandoned entirely. These results are consistent with those from previous years. We found that whooping cranes nest attentiveness showed a similar trend between abandoned and successful nest but that the time eggs were left attended by pairs that eventually abandoned their eggs was much greater than that for nests that were incubated full-term. The maximum time eggs for a successful nest (at least one hatched chick) were left unattended was for 4 hours and 32 minutes (Figure 17) while the maximum time an abandoned nest was left unattended (day of abandonment excluded) was 12 hours and 1 minute (Figure 17 and Appendix 1 to 18). The maximum time an egg from a whooping crane renest (2^{nd} nest of the season) was left unattended was 9 hours and 35 minutes (Figure 18 and Appendix 1 to 18). Successful whooping crane pairs left their eggs unattended an average of 6.3 times while pairs that eventually abandoned their nests left their eggs unattended an average of 12.1 times (Appendix 1 to 18). Given these numbers and that successful pairs had a longer incubation period (30 days) than unsuccessful pairs (17.1±2.1 days), unsuccessful pairs had a much higher rate leaving their eggs unattended (0.71 times per day) than successful nests (0.21 times per day).
7) **Whooping crane nest abandonment**: We were able to provide more evidence that whooping crane incubation length (or nest abandonment) is likely affected by several factors including pair experience, energetics, biting insects, captive history, etc. This point is illustrated by examining single variable graphs (see Figures 19, 20, 21, 22, 23 and 24) and supports the Refuge's use of multidimensional modeling to gain insight into whooping nesting ecology and behavior.

Collaboration: For purposes of evaluating the release program and to promote transparency in resource management, the Necedah National Wildlife Refuge has made all raw data resulting from its whooping crane nest research available to all members of the Whooping Crane Eastern Partnership. This includes all nest video as well as nest images collected with cameras. Refuge staff also entered nest observations (after a nest became active) into a Whooping Crane Eastern Partnership nest observation database so all project partners should be able to independently evaluate different management strategies.

For publication purposes, Necedah National Wildlife Refuge will continue to collaborate with scientists from inside and outside the U.S. Fish and Wildlife Service to publish data resulting from its whooping crane nest research. A summary of those project/papers follows:

1) **Daily Nest Survival**: This paper is a collaboration between S. Matteson (Wisconsin Department of Natural Resources), K. Kenow (U.S. Geological Survey), and D. Varner (Auburn University).

Daily nest survival of trumpeter swans, sandhill cranes, whooping cranes and common loons (all species are relatively new to central Wisconsin and all species are known to attract black flies) is the focus of this project. Data through the 2010 nesting season have been analyzed. Publication of this paper was postponed to allow use of data from 2011 as a sample size for sandhill crane nests from 2010 was smaller than desired.

2) **Crane Comfort Behaviors**: This paper is collaboration with B. Gray, M. Meier, and P. McKann of the U.S. Geological Survey and M. Putnam. Data analysis (including 2011 data) will begin this September. Analysis will focus on four questions: Do comfort behaviors differ between cranes when they are on versus off their nest? Do nesting sandhill cranes and whooping cranes have different levels of comfort behaviors? Does comfort behavior level differ between successful and unsuccessful whooping cranes? Do whooping crane comfort behaviors change in relation to black fly abundance?
3) **Biting Insect**: This project is collaboration with P. Adler, C. Bedwell, and K. Gleason of Clemson University. This paper will focus on insect diversity in and around Necedah National Wildlife Refuge with special emphasis on species never collected before in Wisconsin and/or the lower forty-eight states.
4) **Whooping Crane Nest Attendance**: This analysis will begin this September and utilize whooping crane time budget data. Specifically, whooping crane nest attentiveness will be modeled with environmental and biting insect data as well as data related to the cranes themselves.

Figure 1. Whooping crane arrival dates on central Wisconsin nesting territories.

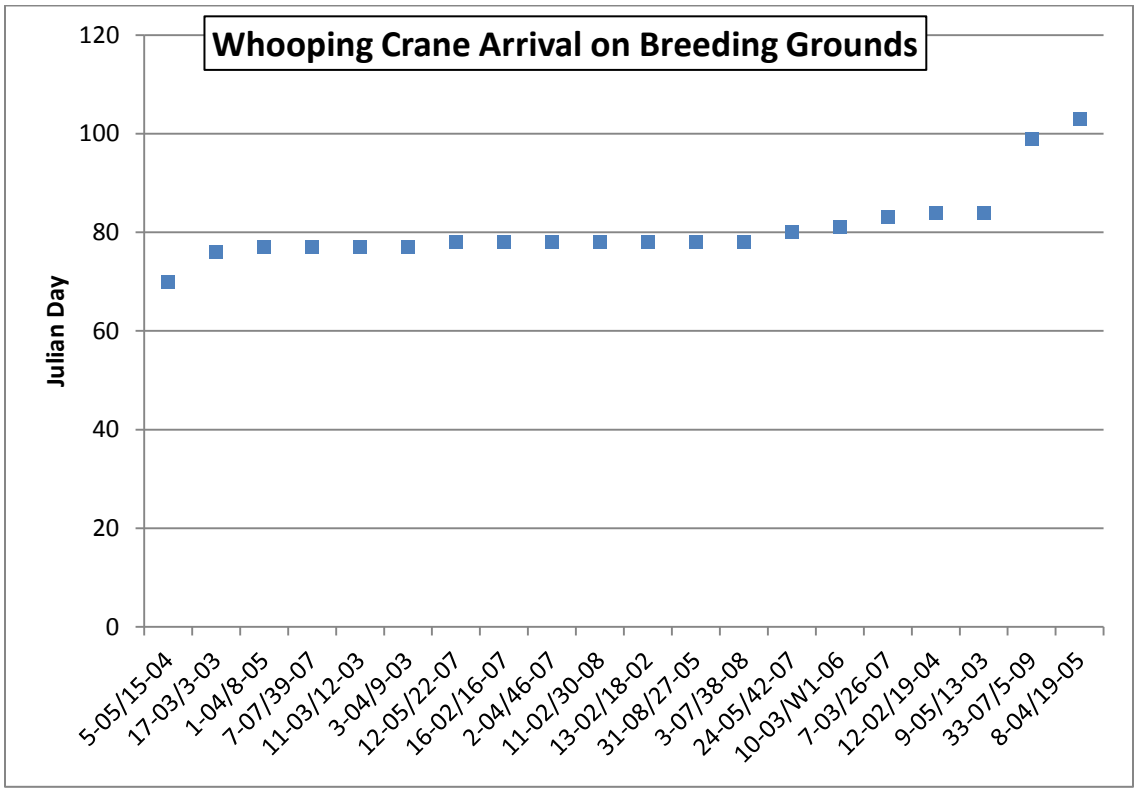


Figure 2. Whooping crane nest locations on or near Necedah National Wildlife Refuge.

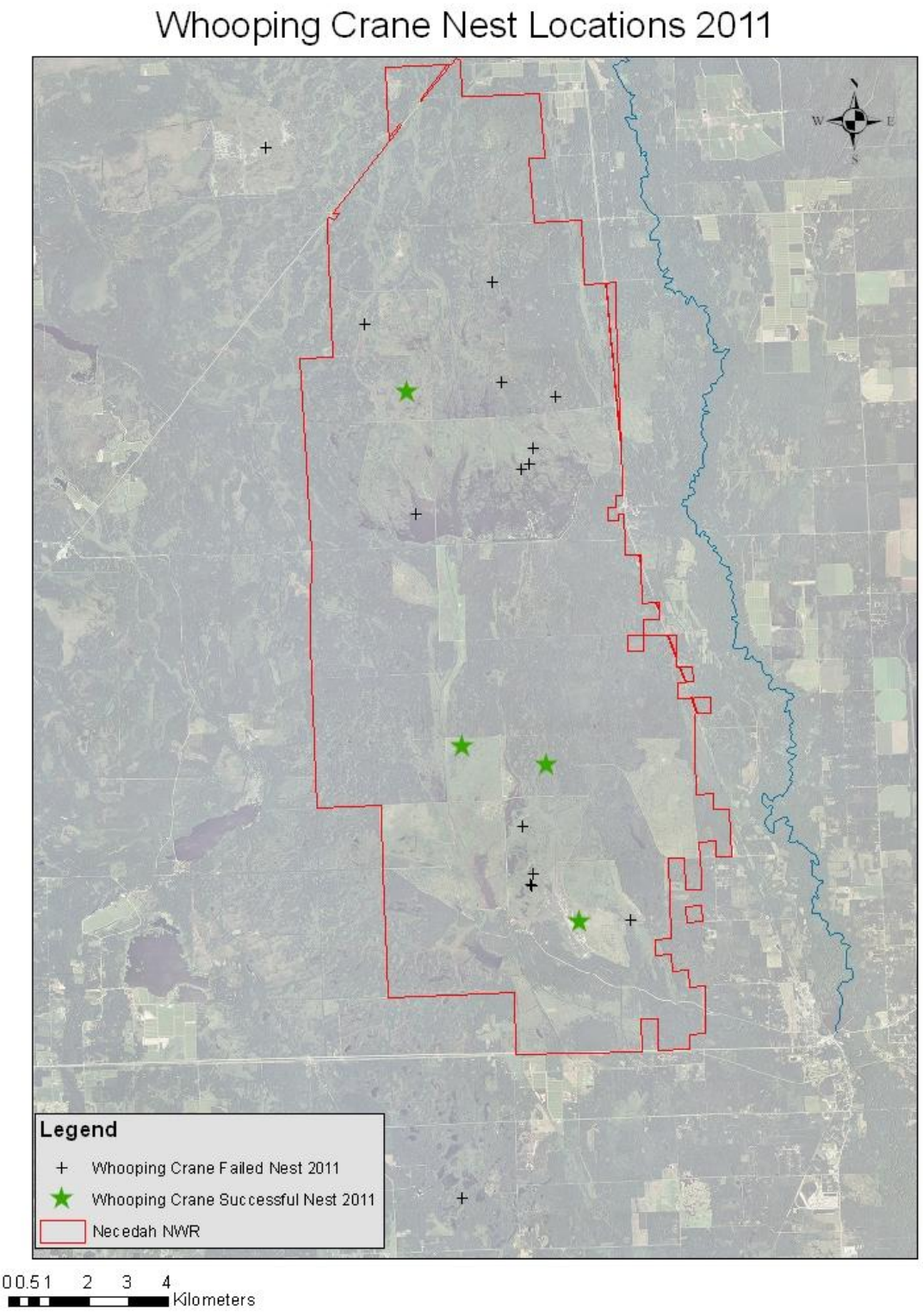


Figure 3. Whooping Crane Nesting Phenology.

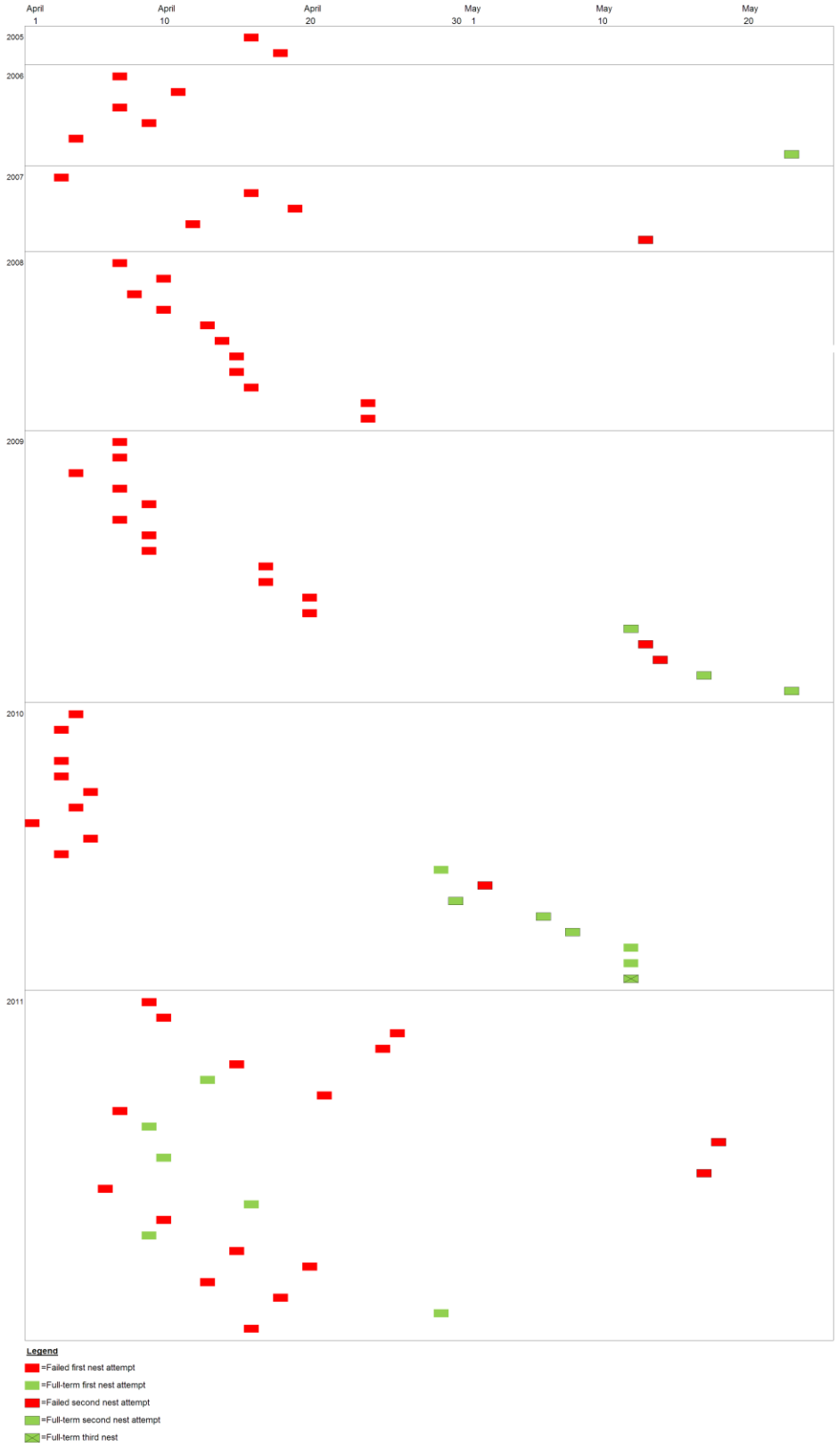
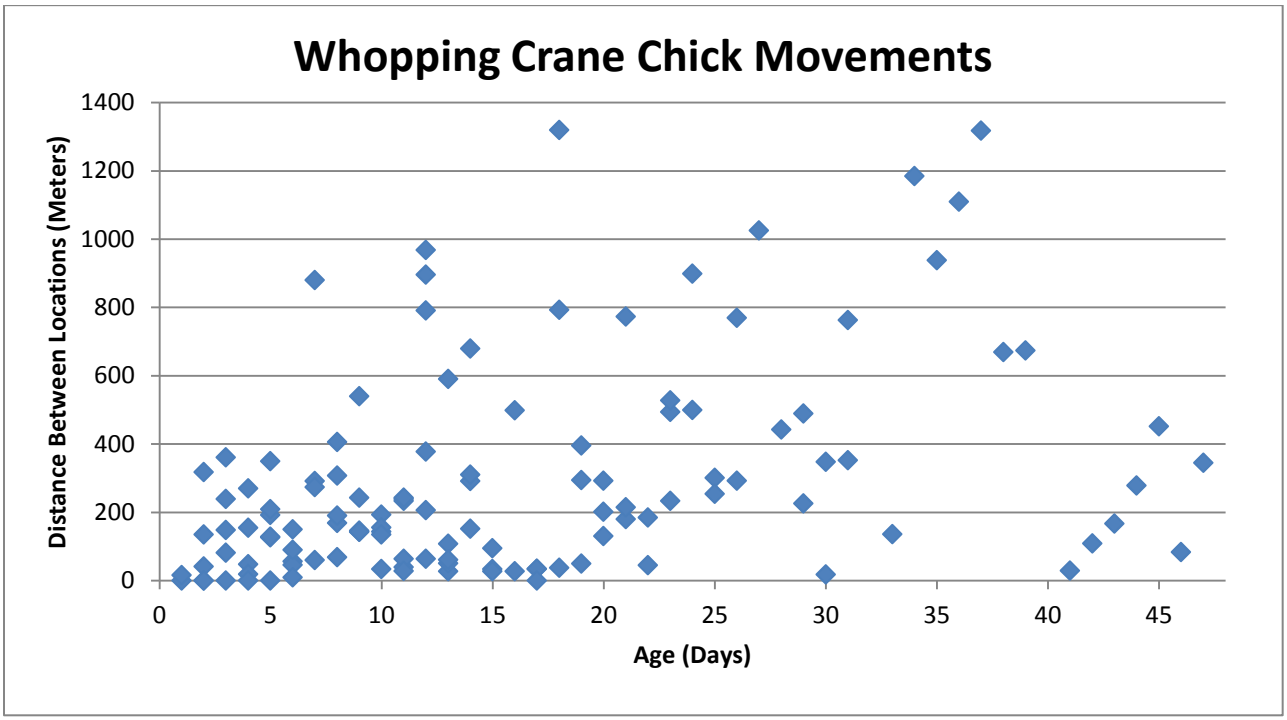
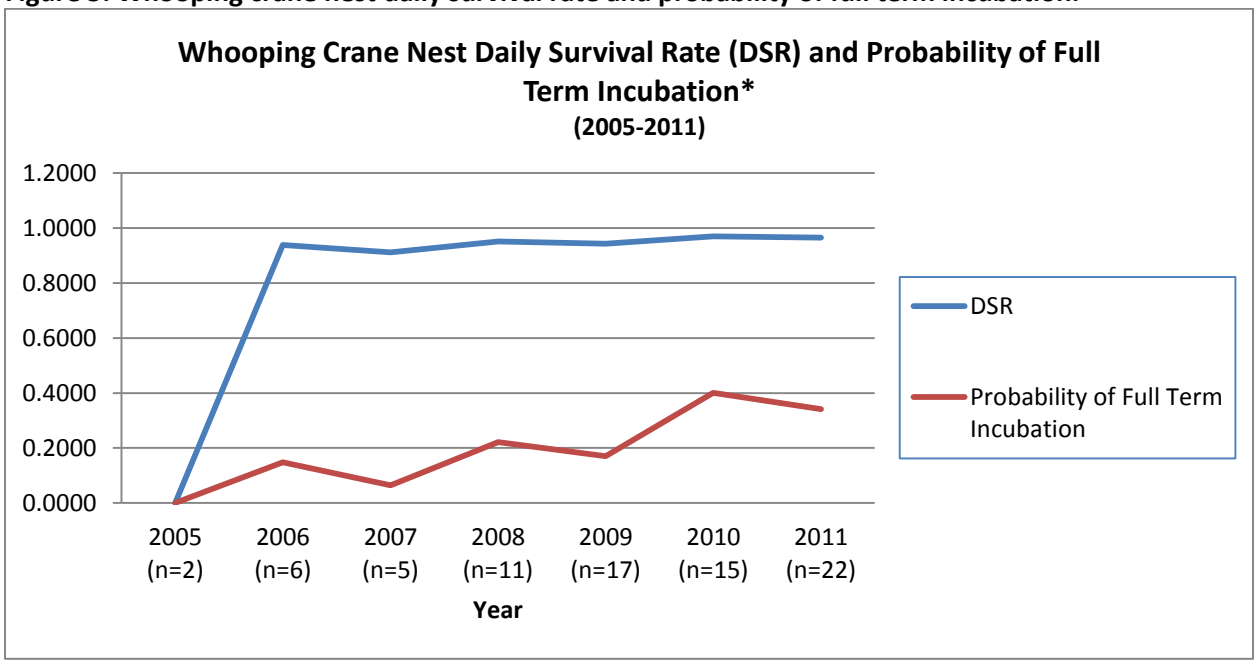


Figure 4. Whooping crane chick movements by age (days).



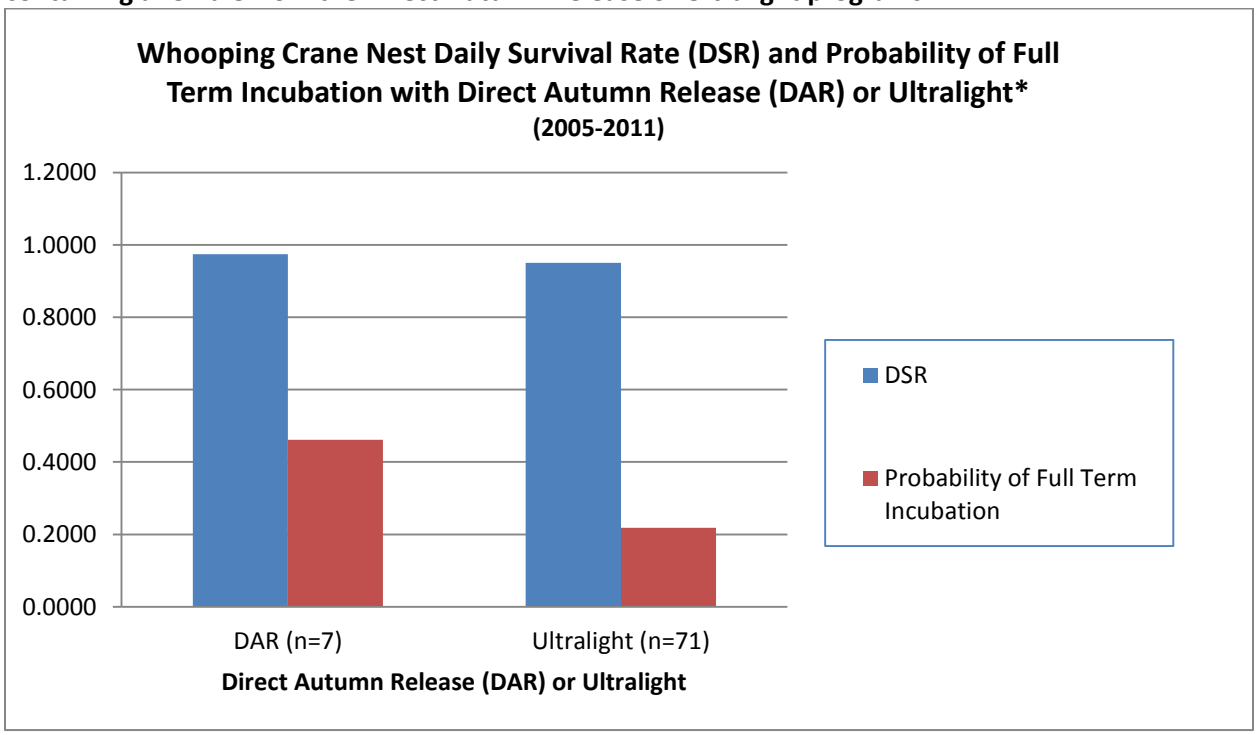
*Whooping crane chicks are monitored twice per day from age 1 to 30. After day 30, chicks are monitored once per day.

Figure 5. Whooping crane nest daily survival rate and probability of full term incubation.



*Two nests from 2010 are excluded from the figure because the nests were abandoned after nest cameras were placed near the nests.

Figure 6. Whooping crane nest daily survival rate and probability of full term incubation for pairs containing a female from the Direct Autumn Release or Ultralight programs.



*Nests from a pair containing a wild produced female (2009, 2010, and 2011) are excluded from this figure. Also, an additional nest from 2010 was excluded because the nest was abandoned after a nest camera was placed near the nest.

Figure 7. Failed and successful whooping crane nest locations inside and out of 10 km treatment zone.

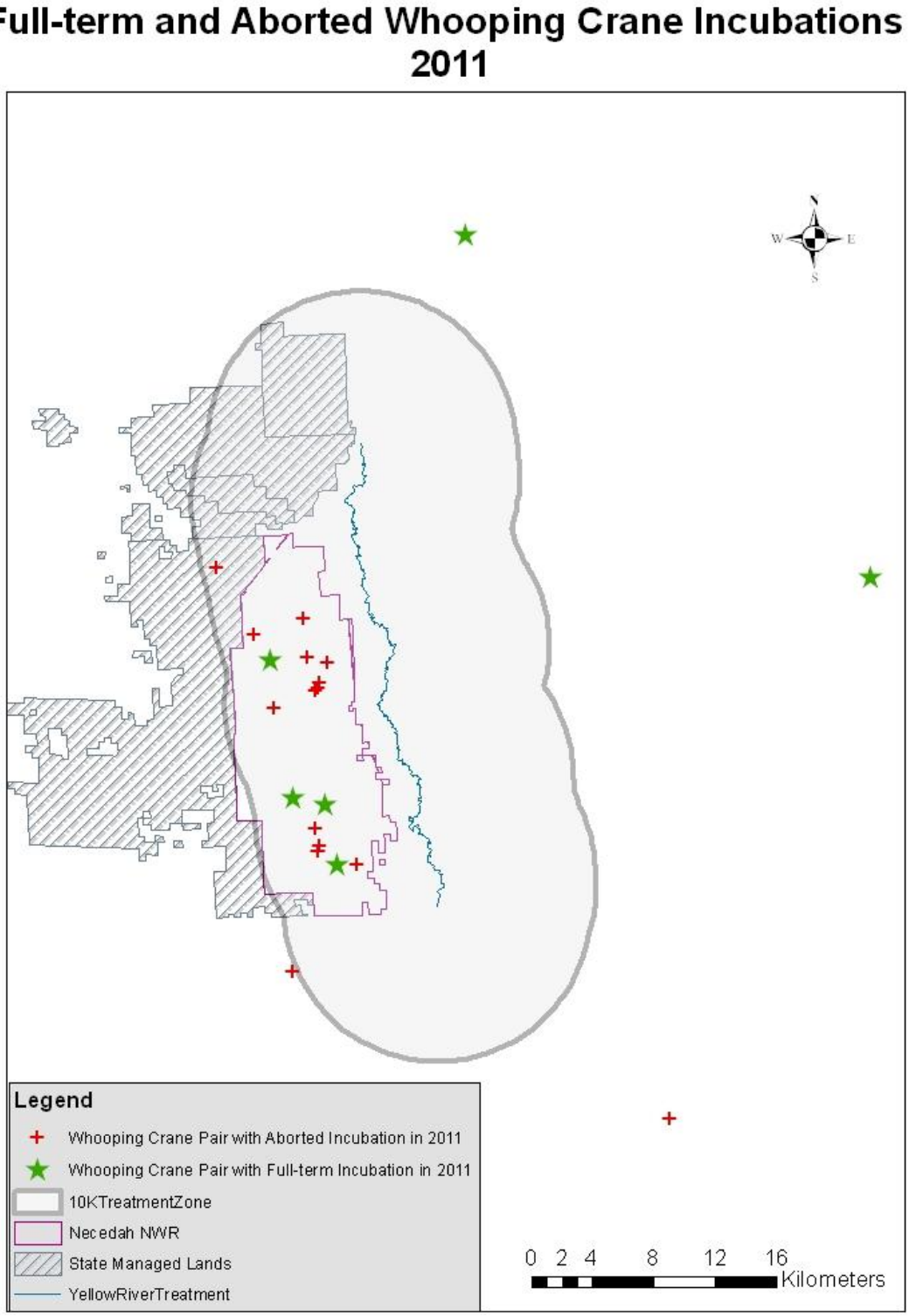


Figure 8. Black fly count using glueboards at whooping crane nest locations within the 10Km Bti treatment zone.

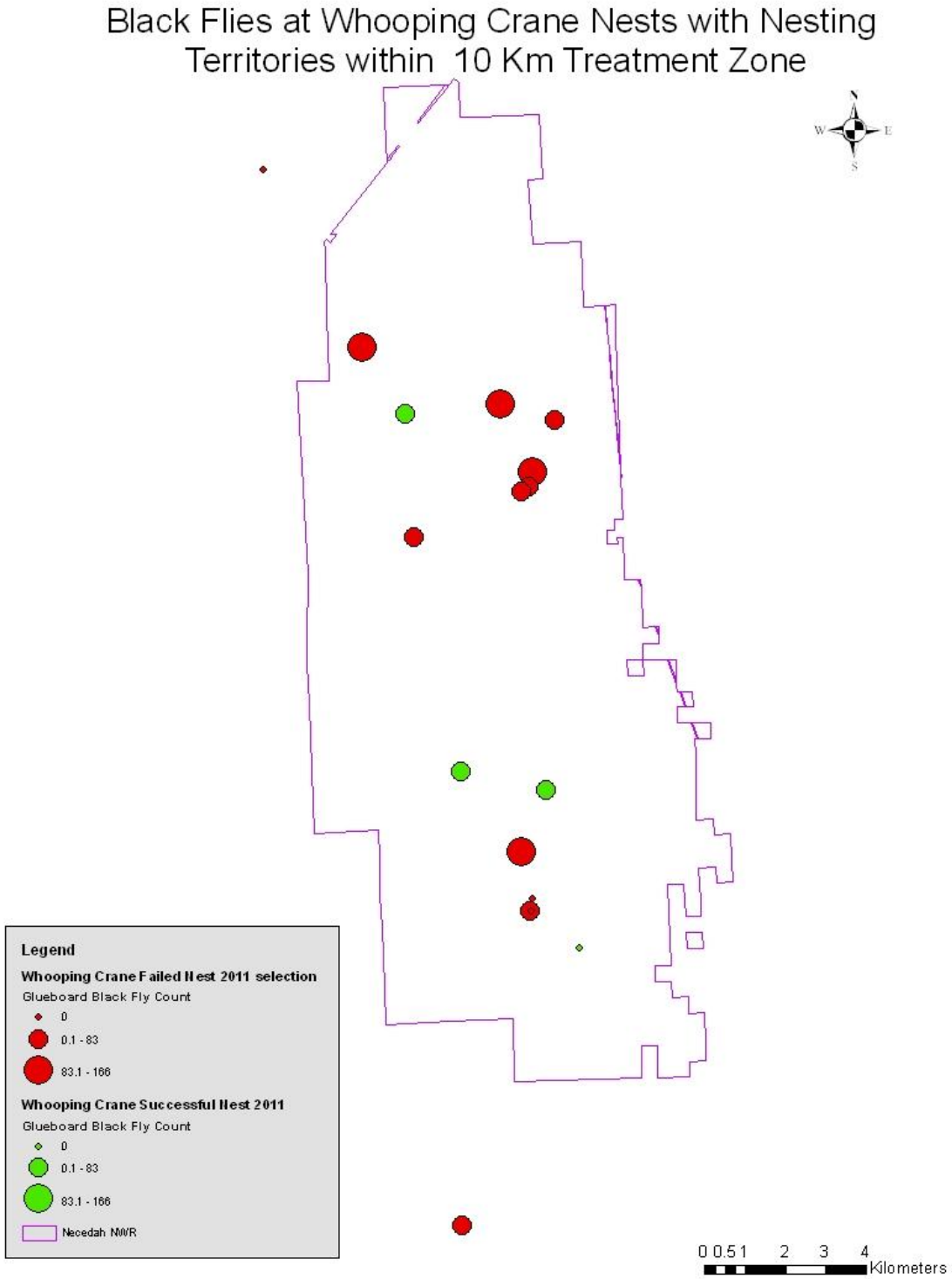


Figure 9. Black fly count on high resolution nest images within 10 Km Bti treatment zone.

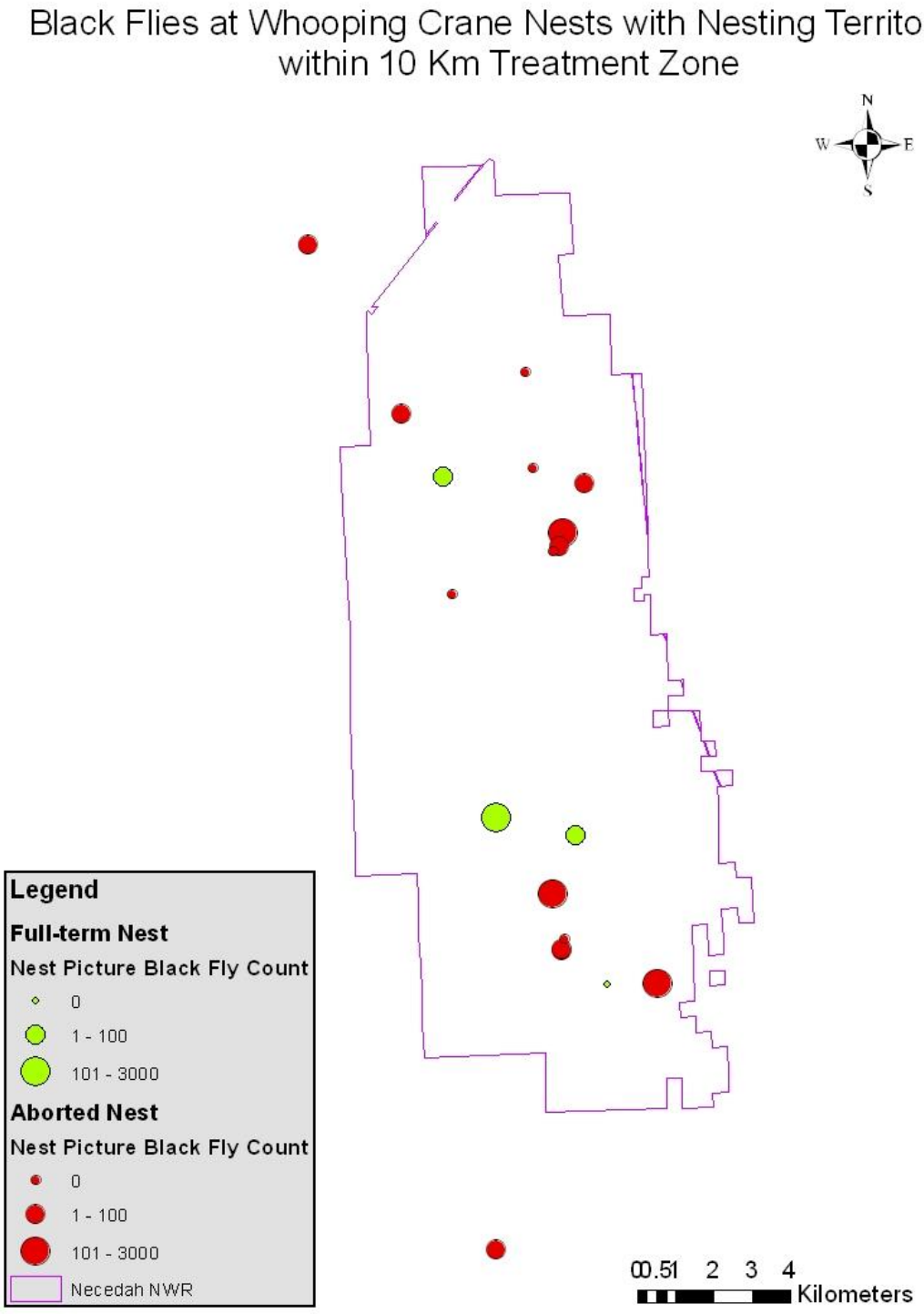


Figure 10. Black flies collected (mean) from glueboards during visits to whooping crane nests.

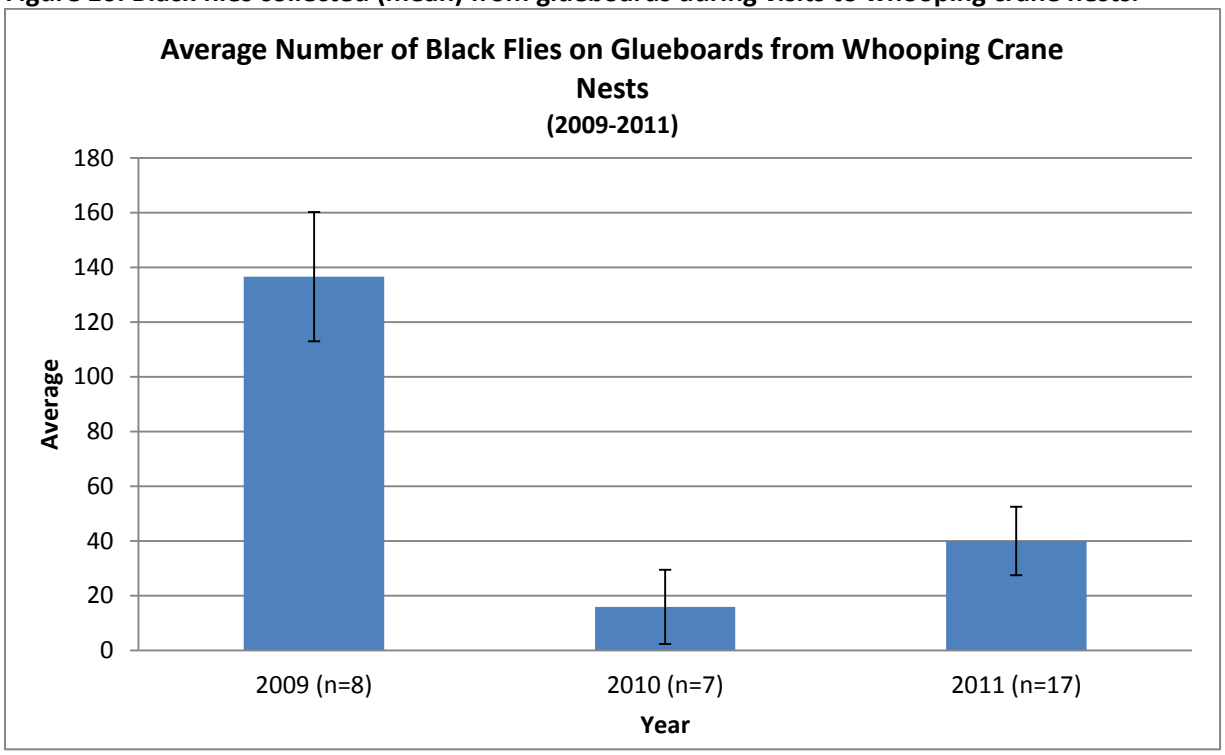


Figure 11. Black flies counted (mean) using high resolution photos of whooping crane nests.

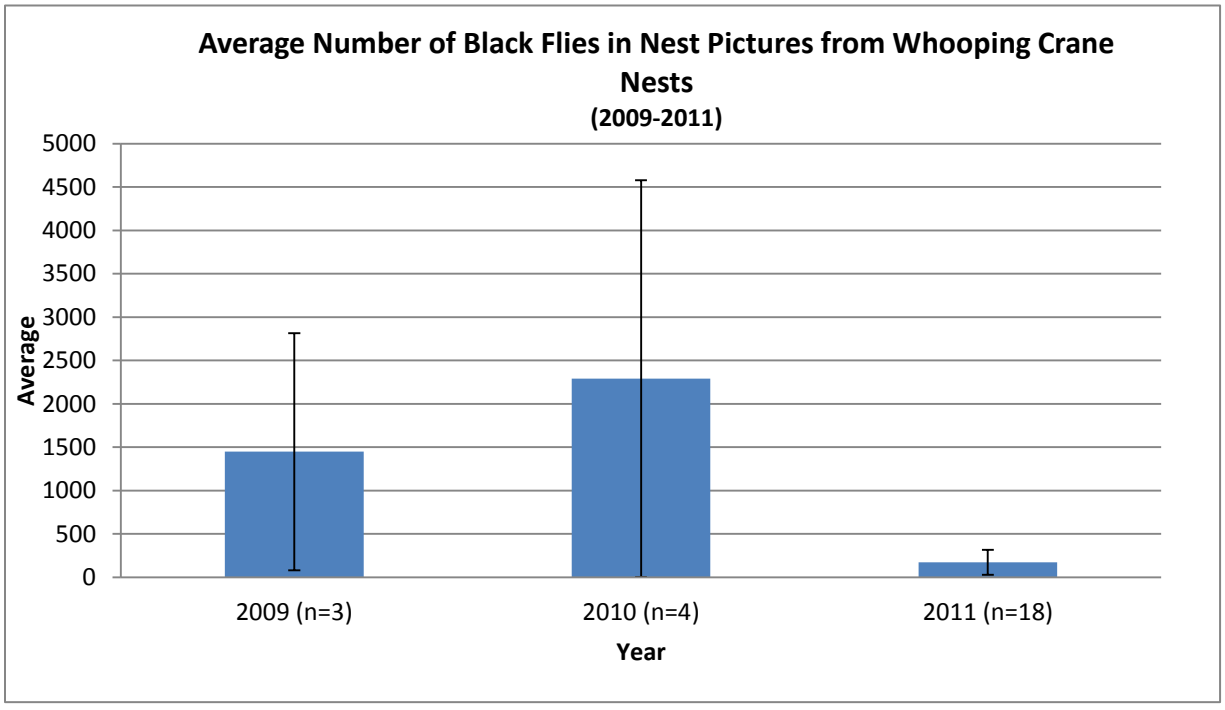


Figure 12. Black flies collected from glueboards during visits to whooping crane nests.

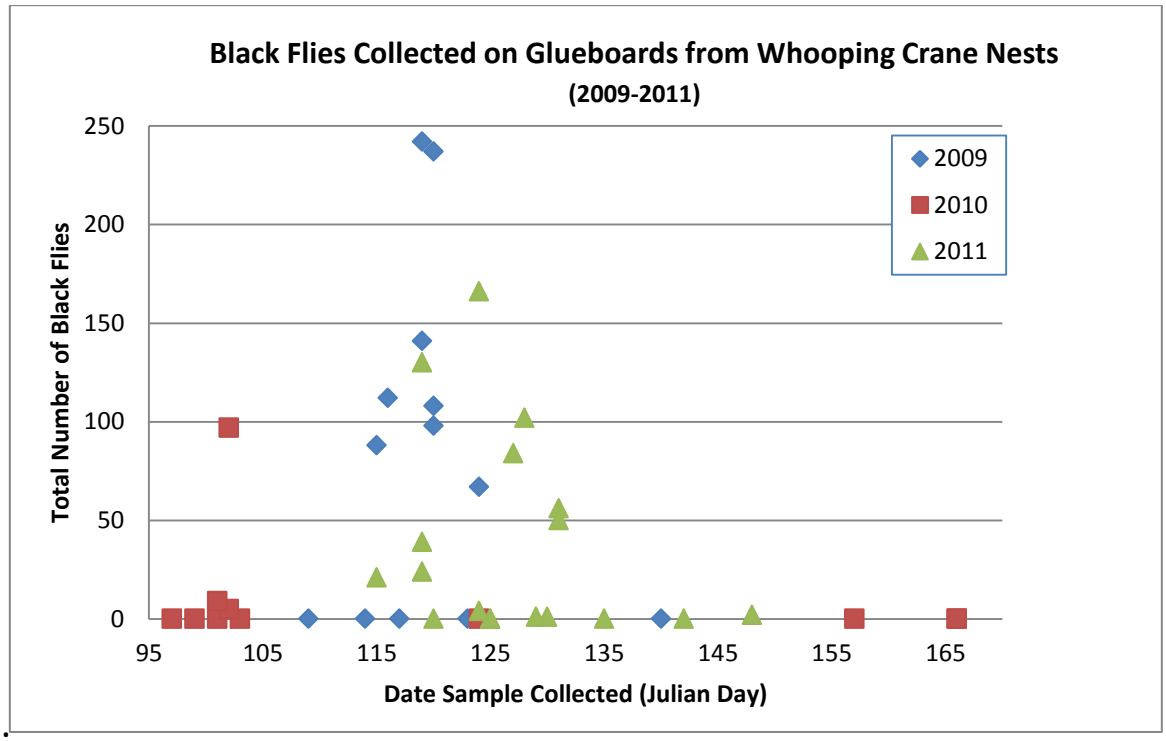


Figure 13. Black flies counted using high resolution photos of whooping crane nests.

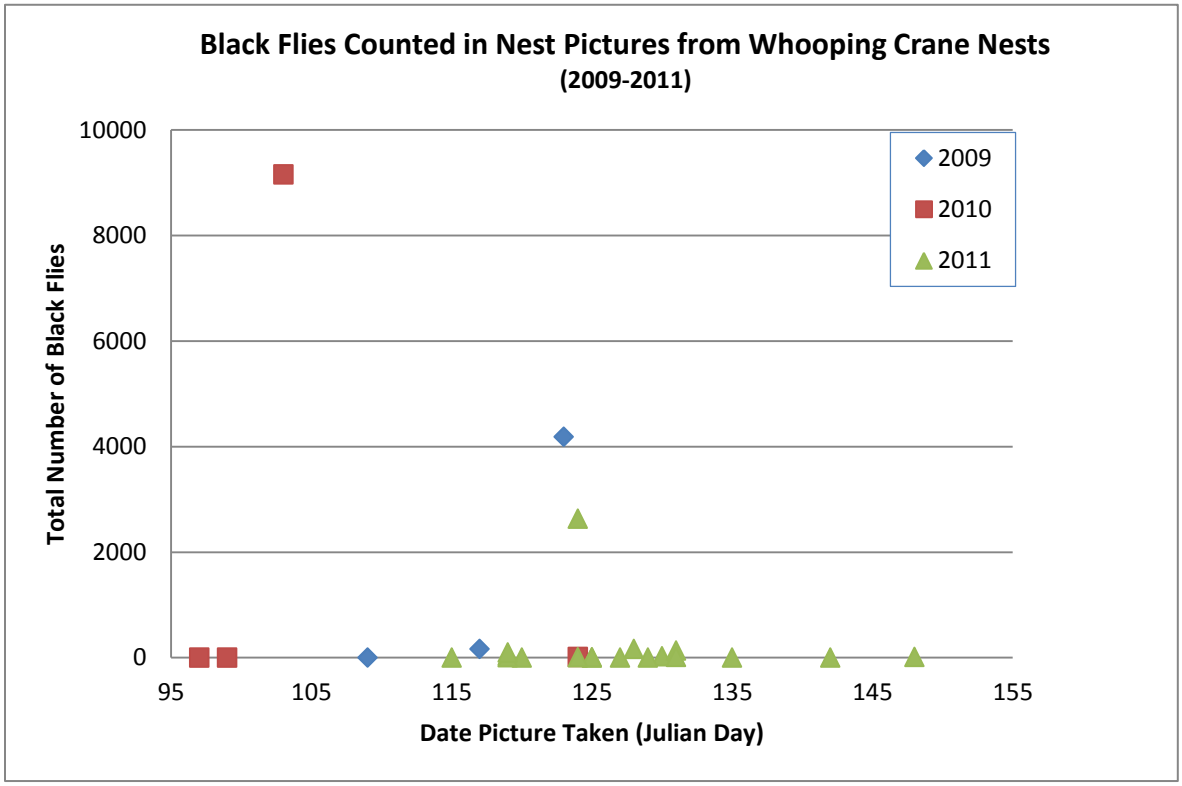
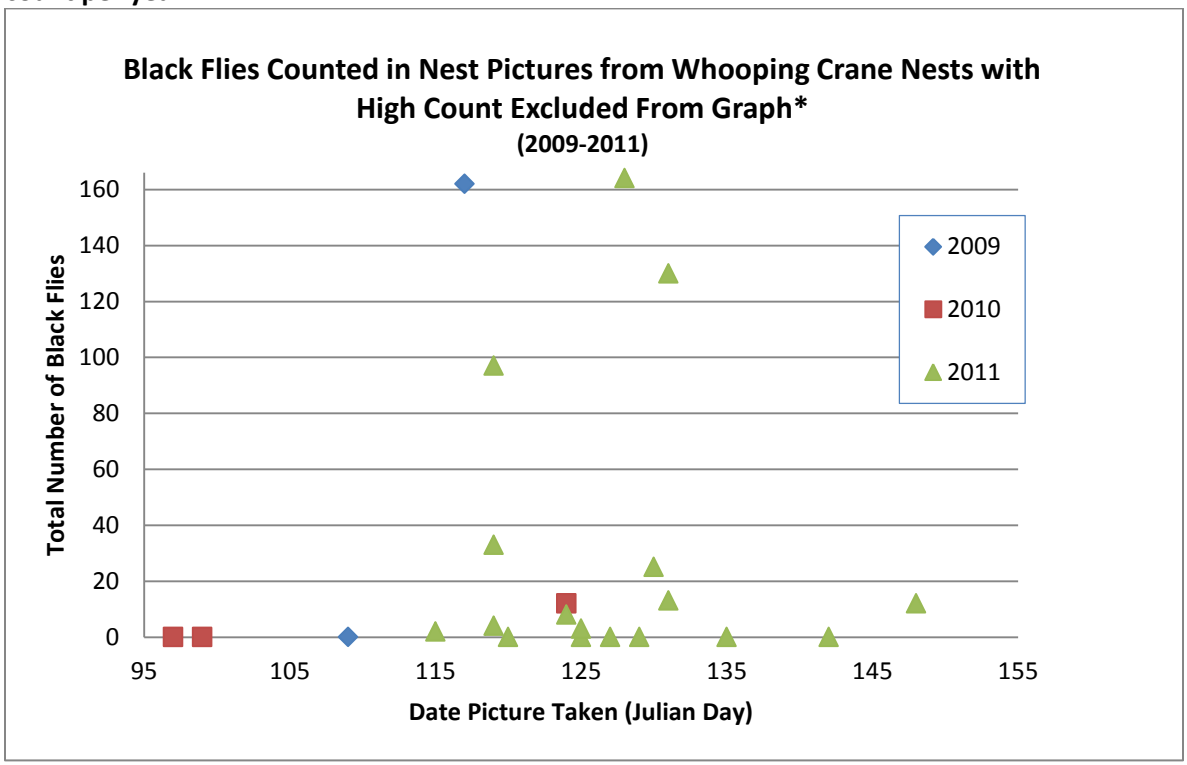


Figure 14. Black flies counted using high resolution photos of whooping crane nests excluding one high count per year.



*Excluded Data:

Year	Julian Day	Total Black Flies
2009	123	4183
2010	103	9153
2011	124	2631

Figure 15. Black flies counted (log_{10}) using high resolution photos of whooping crane nests.

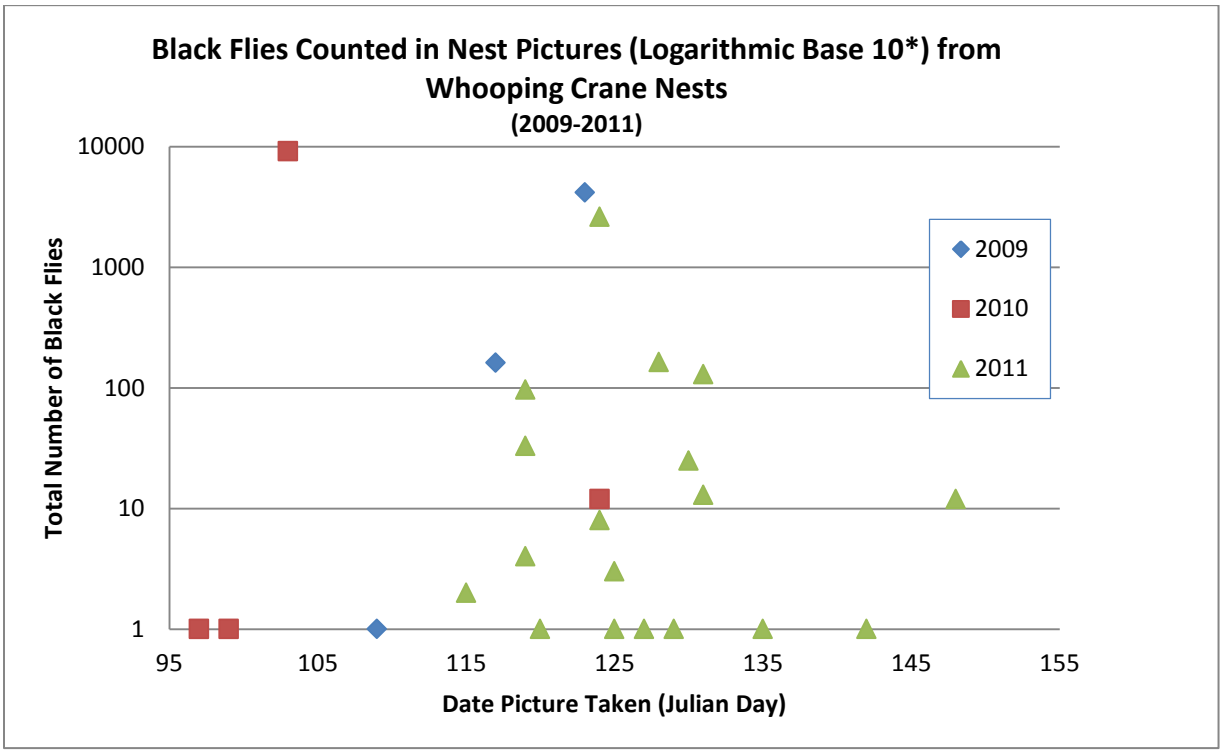


Figure 16. Whooping crane daily survival rate and probability of full term incubation inside and outside 10km treatment zone for black flies.

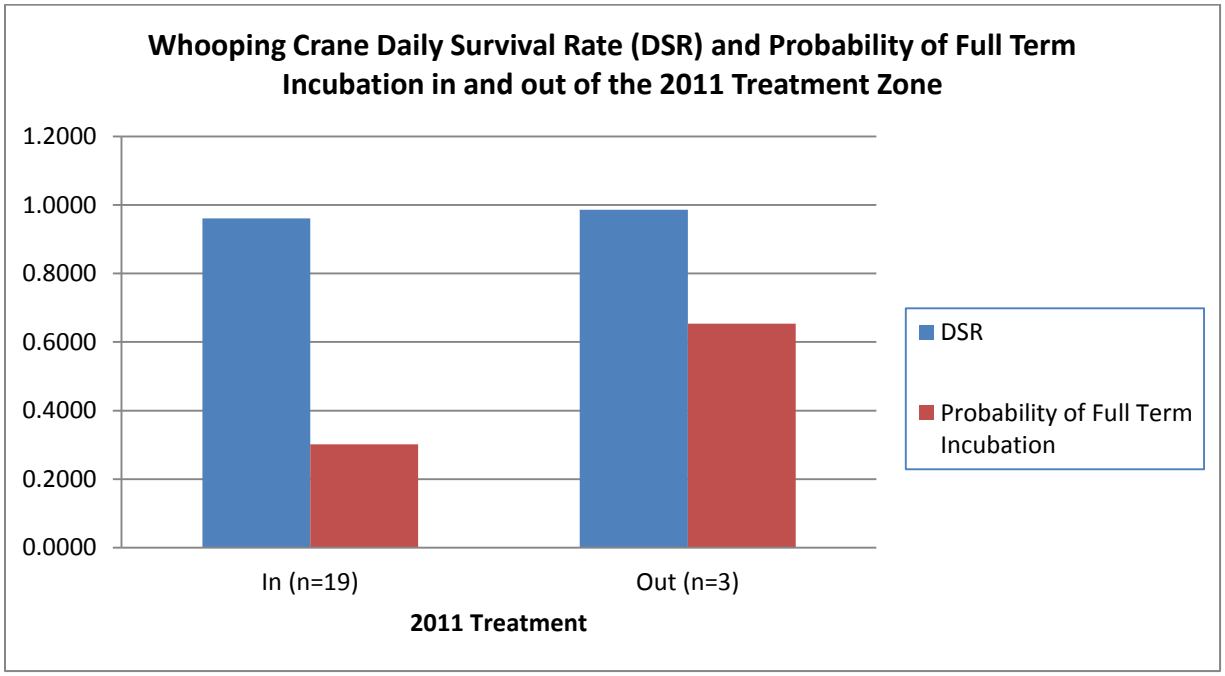
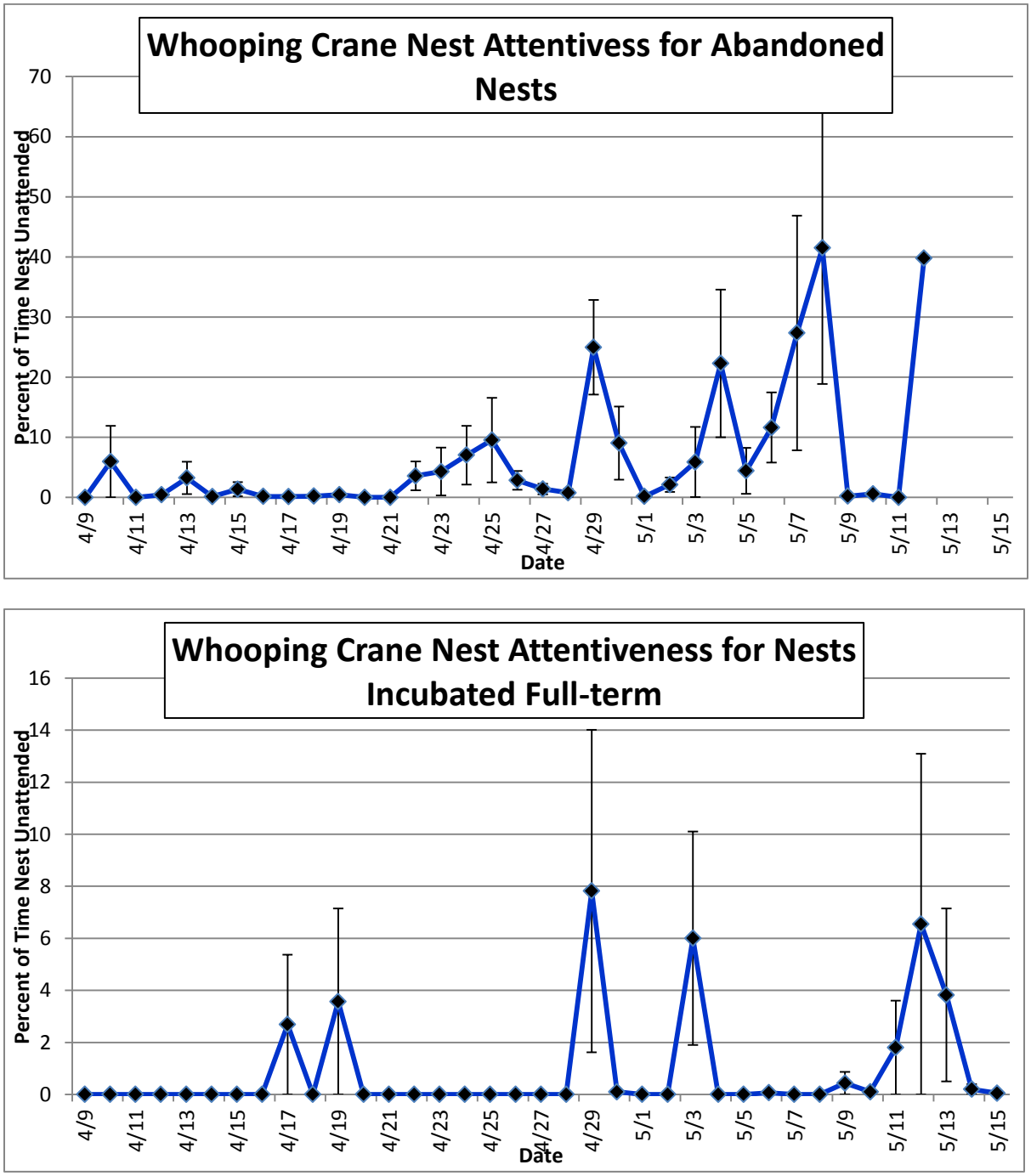
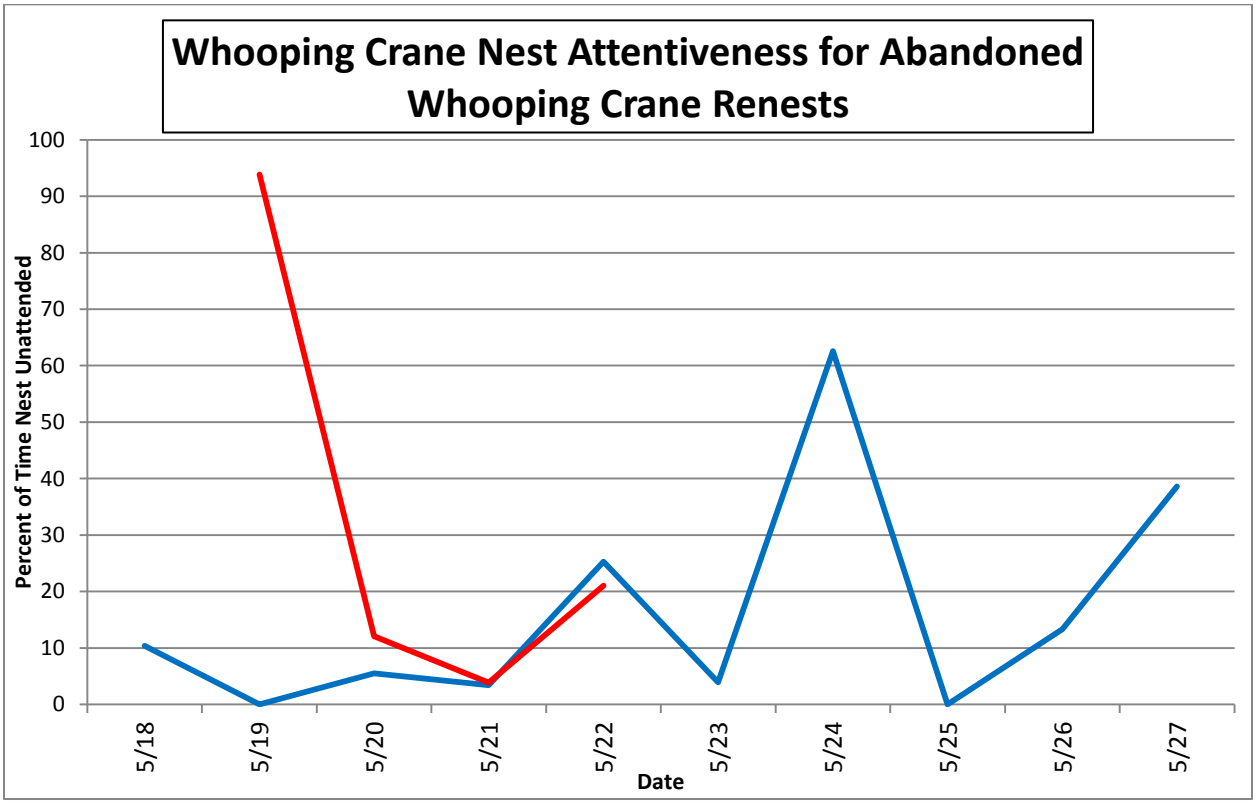


Figure 17. Nest attentiveness for abandoned and full-term whooping crane incubations (2011).



*This figure represents the percent of time whooping crane pairs left their eggs unattended on a given day. Time spent off the nest for nest exchanges is not included in these figures. Data represent mean for days with more than one active nest and individual data points for days with one active nest. Data representing more than one nest (mean) are illustrated with error bars (±SE). Data points representing individual nests do not have error bars.

Figure 18. Nest attentiveness for two whooping crane renests (2nd nest attempt of the year).



*This figures represent individual data point for two whooping crane renests (2nd nest of the year).

Figure 19. Whooping crane incubation length and nest initiation date.

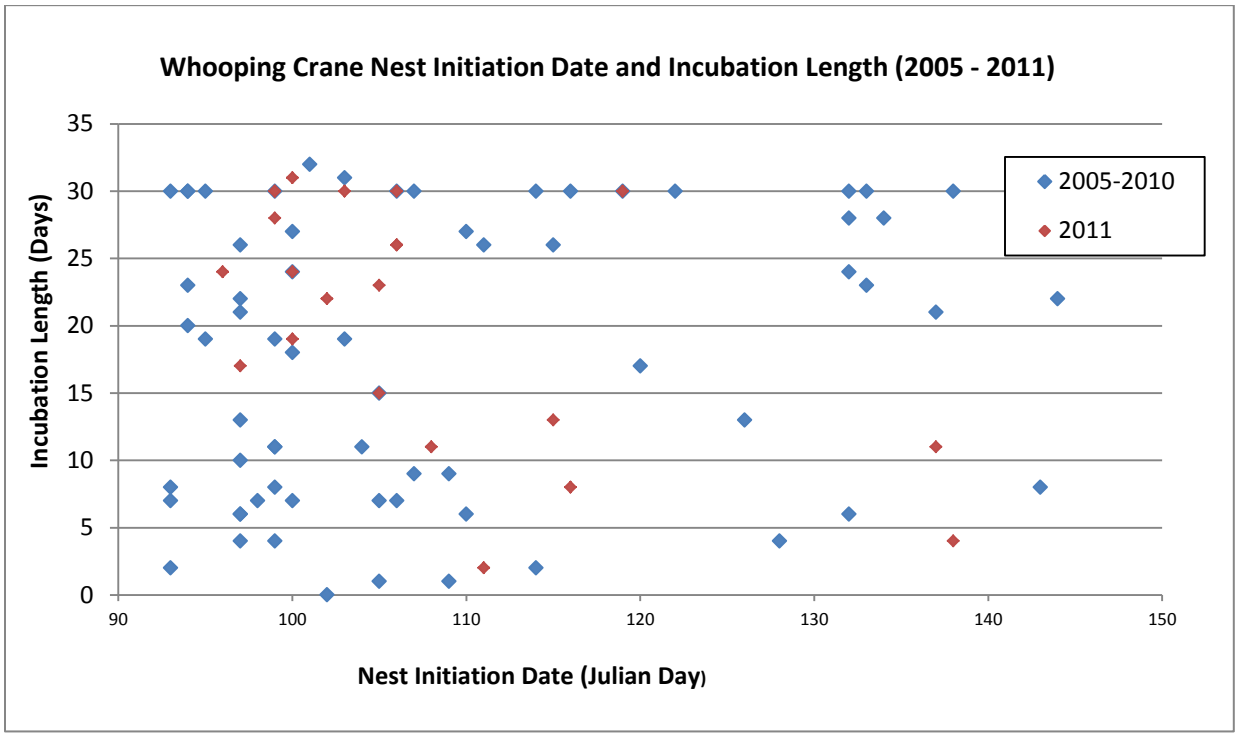


Figure 20. Whooping crane incubation length and days between arrival and nest initiation.

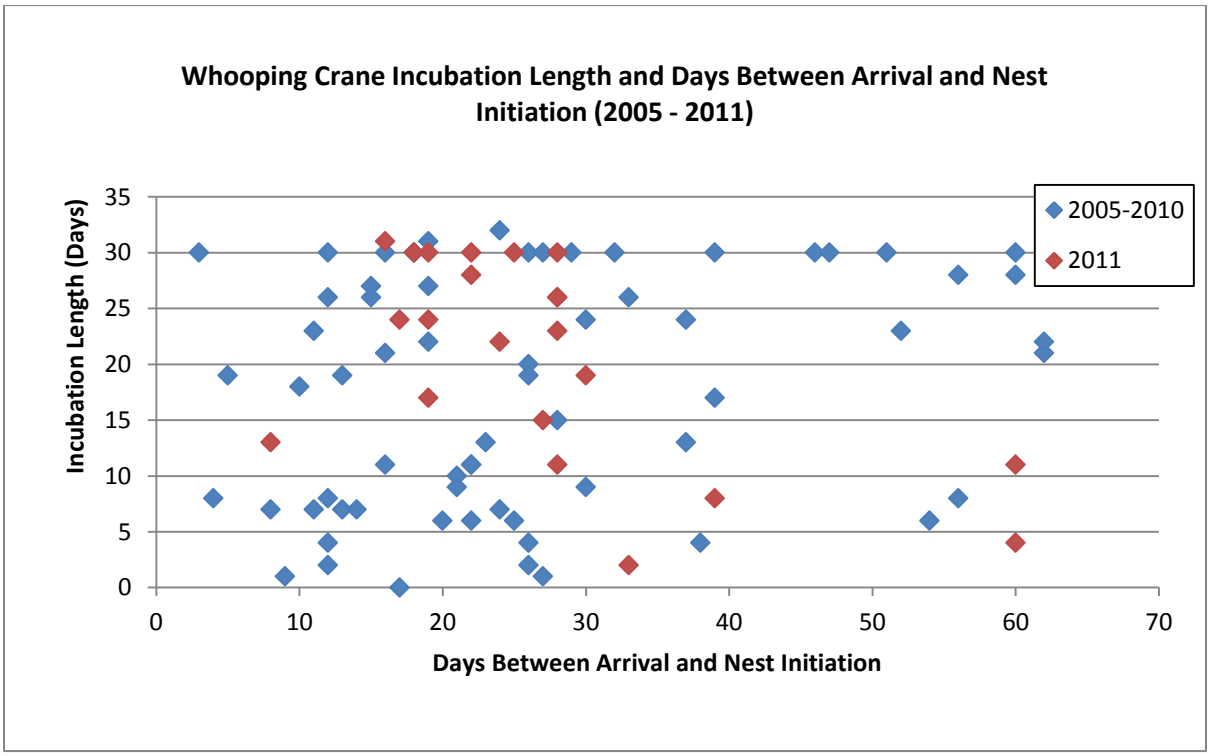


Figure 21. Whooping crane incubation length and arrival date.

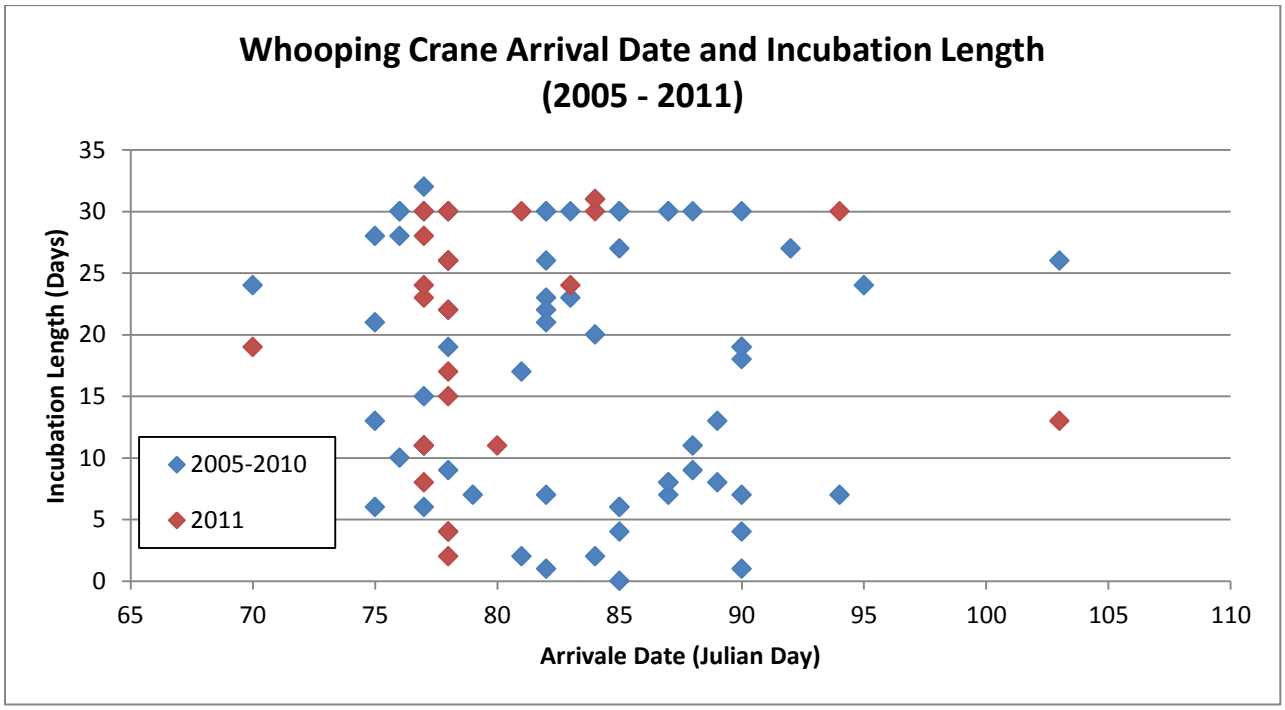


Figure 22. Whooping crane incubation length and distance traveled.

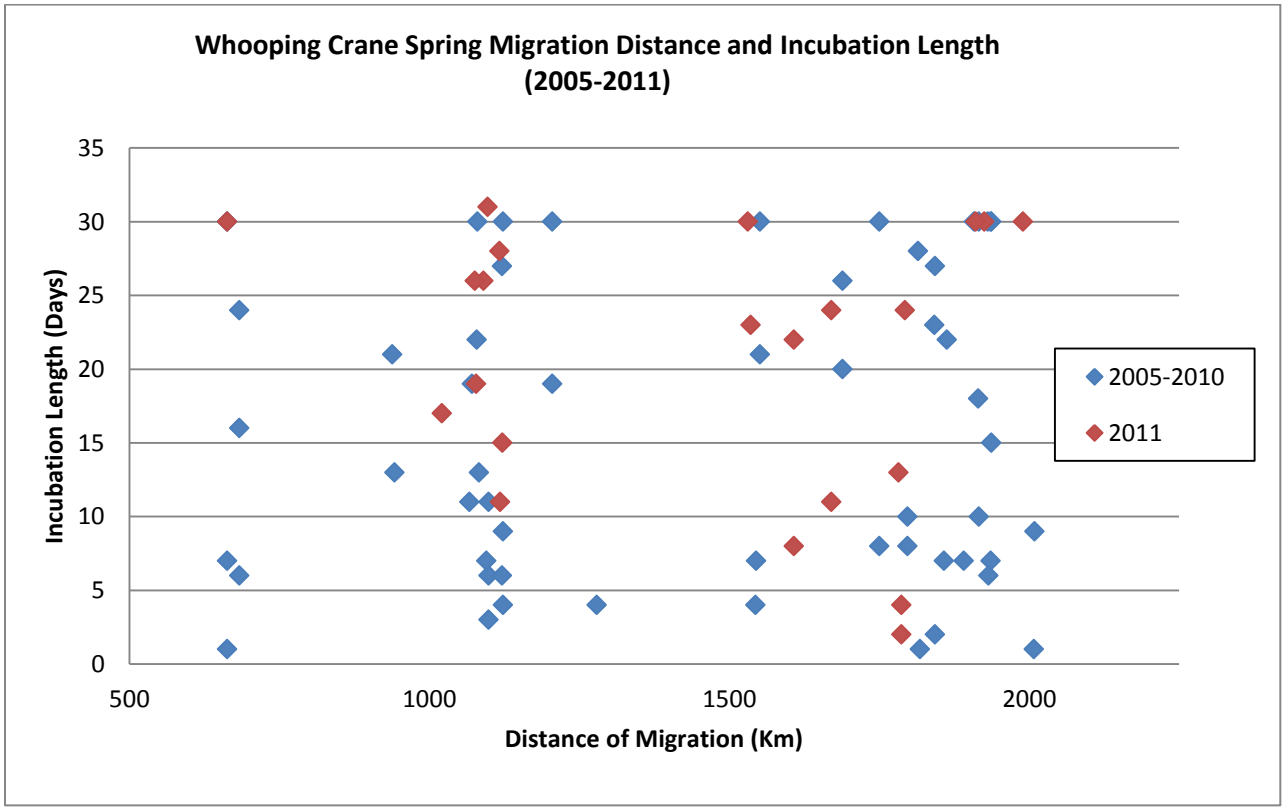


Figure 23. Average incubation length for whooping crane pairs inside and outside 10km treatment zone for black flies.

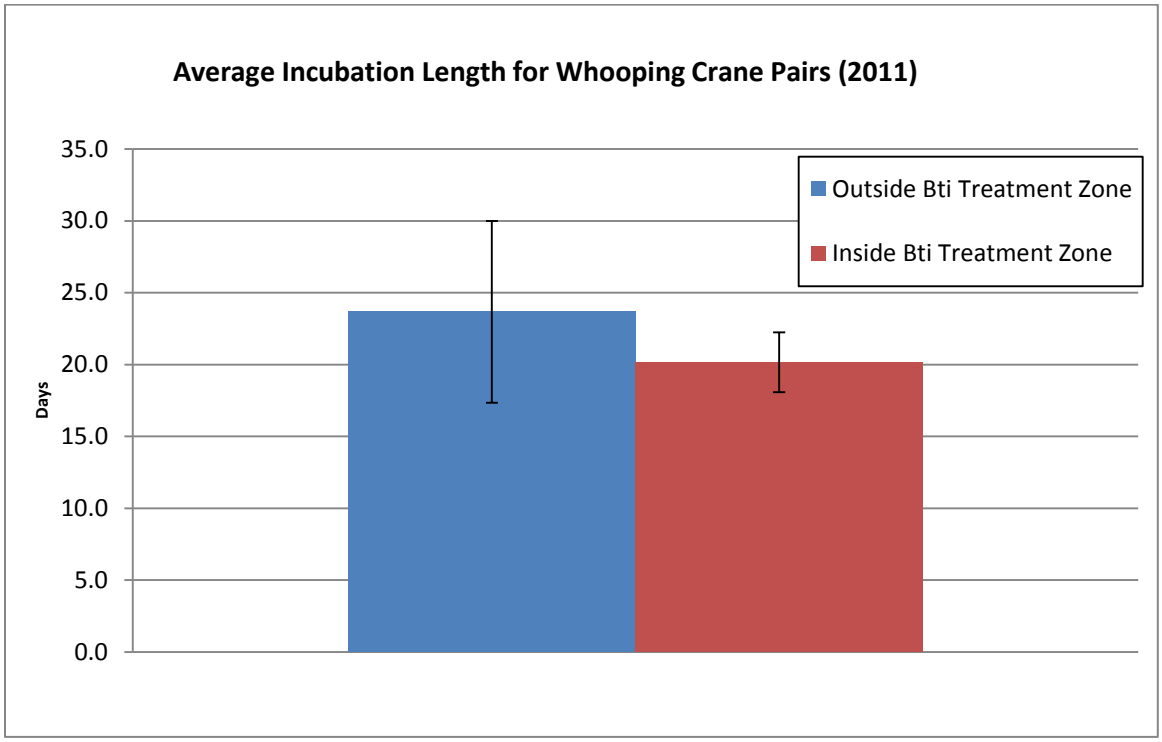


Figure 24. Percentage of Whooping Crane pairs with full-term incubations inside and outside 10km treatment zone for black flies.

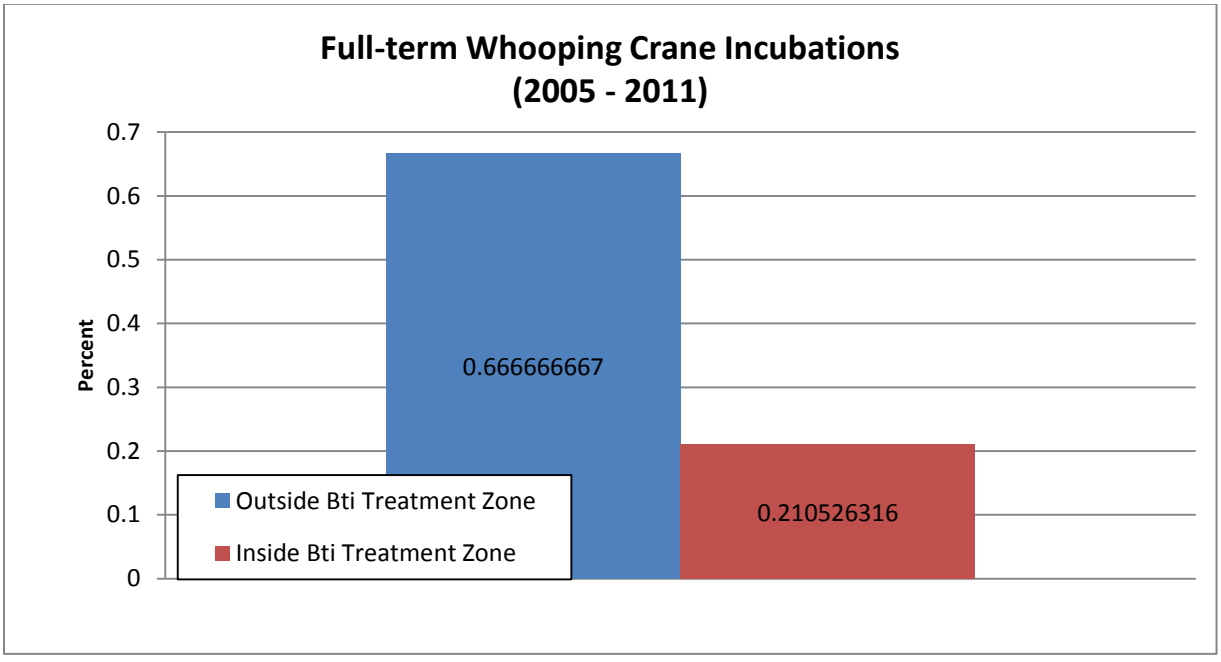


Table 1. Whooping crane arrival dates on central Wisconsin nesting territories.

Pair	Julian Day
5-05/15-04	70
17-03/3-03	76
1-04/8-05	77
7-07/39-07	77
11-03/12-03	77
3-04/9-03	77
12-05/22-07	78
16-02/16-07	78
2-04/46-07	78
11-02/30-08	78
13-02/18-02	78
31-08/27-05*	78
3-07/38-08	78
24-05/42-07	80
10-03/W1-06	81
7-03/26-07	83
12-02/19-04	84
9-05/13-03*	84
33-07/5-09	99
8-04/19-05*	103

*Paired after arrival. Date given is the last arrival date for the pair.

Table 2. Black fly count for whooping crane nests in 2011 from nest pictures and glueboard samples.

Pair	Number of Black Flies from glueboards 2011	Number of Black Flies from Nest Pictures 2011
10-03/w1-06	1	25
1-04/8-05	84	0
11-03/12-03	102	164
12-02/19-04	0	0
12-05/22-07	39	4
12-05/22-07 (second nest)	1	0
17-03/3-03	50	13
27-05/31-08	24	33
3-04/9-03	0	22
3-04/9-03 (second nest)	2	12
5-05/15-04	130	97
7-03/26-07	166	2631
7-07/39-07	0	3
8-04/19-05	1	0
9-05/13-03	56	130
2-04/46-07	0	0
13-02/18-02	0	0
16-02/16-07	21	2
11-02/30-08	Decoy not run	149
3-07/38-08	Decoy not run	0

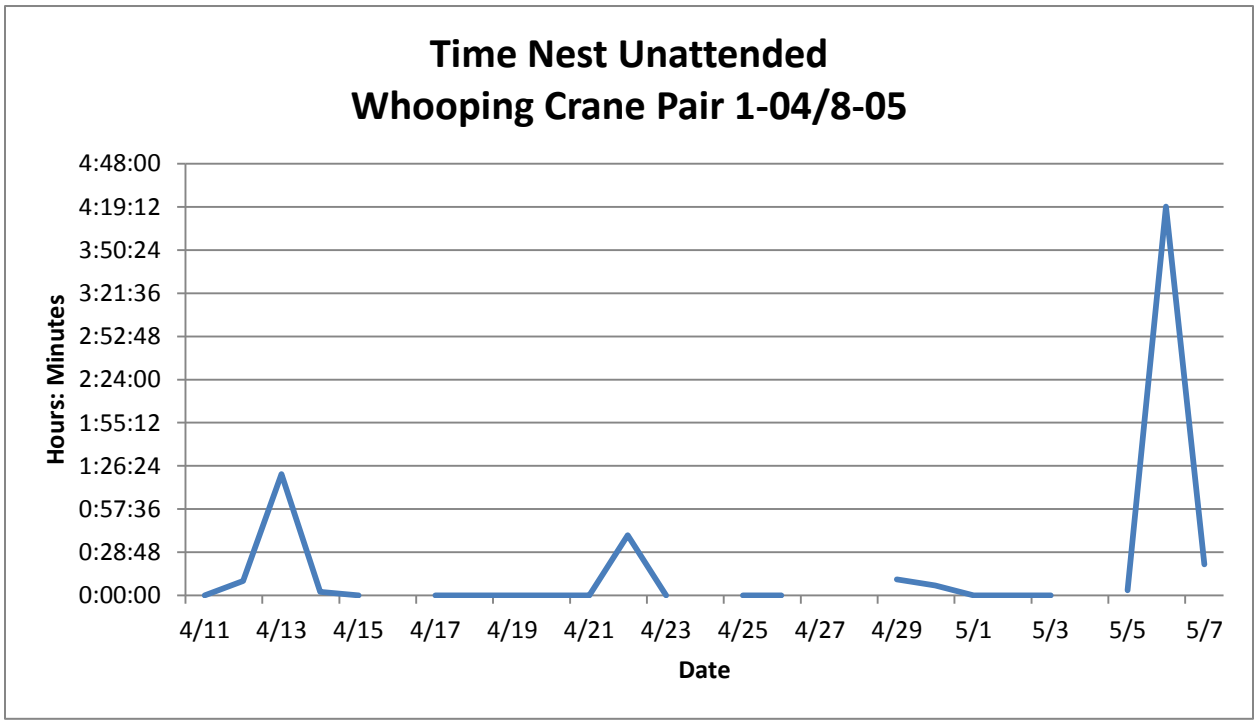
Appendix 1

Nest Report for Whooping Crane Pair: 1-04/8-05

Previous nest attempts (with egg): 3

History: This pair formed in 2008 and built a nest in that same year. They have built a nest each year since 2008.

2011 Nesting Season: The pair returned to Necedah NWR by March 18. The pair began a nest attempt on or about April 11. Nesting ended on May 7, and two eggs were collected on that day. The eggs were found floating in the water about three feet from the nest, and had small puncture holes in them. Subsequent video review showed a crow (*Corvus brachyrhynchos)* tampering with the eggs on the morning of May 7. A decoy was run at the nest on May 7 at approximately 1552, and 84 black flies were collected on the glueboard. The samples were sent to Clemson University for further analysis and results are pending. A high resolution picture was also taken at this time and revealed zero black flies. A camera was set up near the nest on April 11. Between April 11 and May 7, the pair left their nest unattended on at least 16 separate occasions during 9 different days. For any one day, the maximum time the nest was left unattended was at least 4 hours, 19 minutes, and 22 seconds (May 6). A necropsy found that both eggs were infertile. Necropsies for the eggs are attached below. This incubation lasted for approximately 27 days before it was interrupted. There is no video data for April 16, 24, 27, 28 and May 4 due to weather or equipment malfunctions. The pair did not attempt to renest.



Whooping Crane Nest 1-04/8-05 (May 7, 2011)

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP8-05A-11

Incubation initiation date: ~April 9, 2011
Date of Death: NA
Date of Necropsy: May 24, 2011

History: Retrieved from WCEP nest (1-04/8-05) 7 May. Egg length x width: 106.87 x 62.53mm. Volume = 170ml.

Gross necropsy findings: There are 2 curved 4-5mm punctures at the large pole of the egg, penetrating partially into the egg. Upon opening, the egg was determined to be infertile, the blastodisc was plainly visible with no signs of development (blood vessels, etc).

Cultures submitted: None due to infertility.

Tissues saved for histopathology: NA.

Gross diagnosis: Infertile egg.

Final diagnosis: Infertile egg.

Submitted by: Barry Hartup DVM, PhD

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP8-05B-11

Incubation initiation date: ~April 9, 2011
Date of Death: NA
Date of Necropsy: May 24, 2011

History: Retrieved from WCEP nest (1-04/8-05) 7 May. Egg length x width: 112.06 x 64.1mm. Volume = 185ml.

Gross necropsy findings: There are 2 curved 4-5mm punctures at the large pole of the egg, penetrating partially into the egg. Upon opening, the egg was determined to be infertile, the blastodisc was plainly visible with no signs of development (blood vessels, etc).

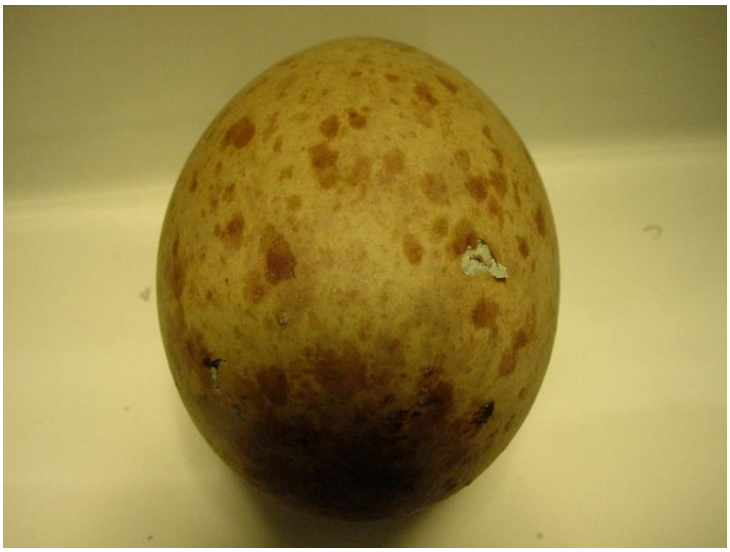
Cultures submitted: None due to infertility.

Tissues saved for histopathology: NA.

Gross diagnosis: Infertile egg.

Final diagnosis: Infertile egg.

Submitted by: Barry Hartup DVM, PhD



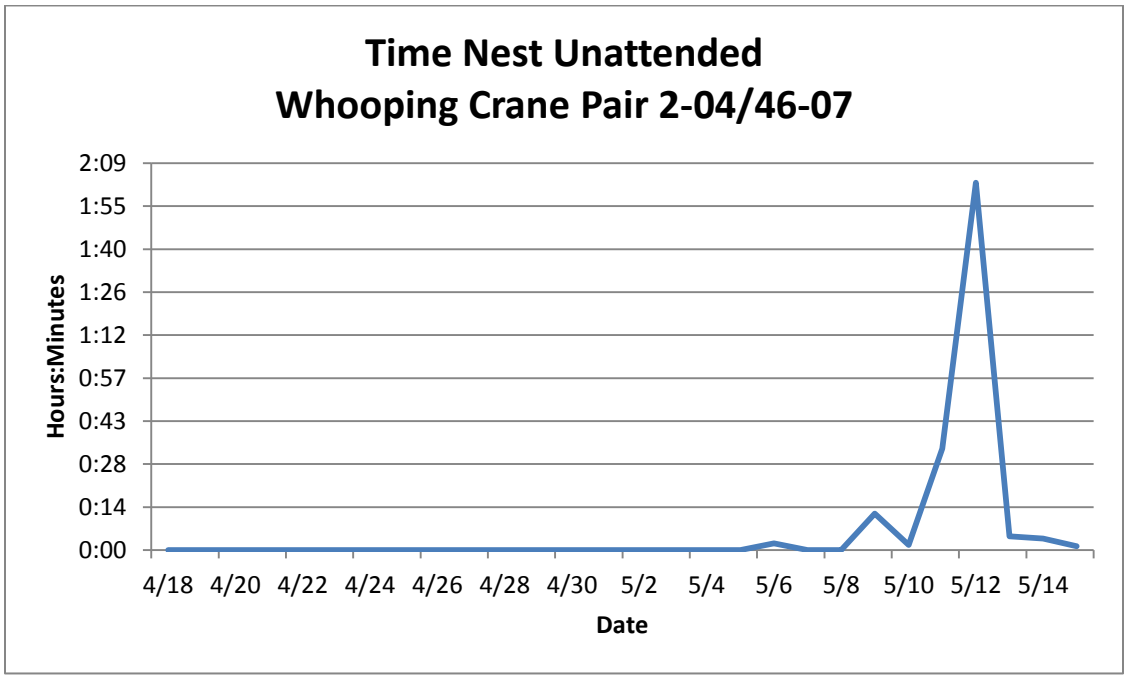
Appendix 2

Nest Report for Whooping Crane Pair: 2-04/46-07

Previous nest attempts (with egg): 1

History: This pair formed in 2010. They produced a nest and an egg that year and the following year.

2011 Nesting Season: The pair returned to Necedah NWR by March 19. The pair began a nest attempt on or about April 16. A nest camera was deployed on April 18 and was replaced with a DVR surveillance camera on May 2. A chick (W4-11) was observed on May 16. The pair and chick remained in the immediate nest area through May 19. The nest was visited on May 22, at which time egg shell fragments were collected. Between April 18 and May 15, the pair left their nest unattended on at least 16 separate occasions during 8 different days. For any one day, the maximum time the nest was left unattended was at least 2 hours, 3 minutes, and 2 seconds. This was a full term incubation, lasting approximately 30 days. A crane decoy with glue board was deployed and a nest picture was taken during the May 22 visit (6 days after hatching). No black flies were observed in or around the nest during this visit. No black flies were collected from the glue board and none were counted in the nest picture. After the death of the chick (see chick report) the pair did not attempt to renest.



Whooping Crane Nest 2-04/46-07 (May 22, 2011)

NATIONAL WILDLIFE HEALTH CENTER 6006
Schroeder Road Madison, Wisconsin 53711-6223 608-270-2400 (FAX 608-270-2415)

DIAGNOSTIC SERVICES CASE UPDATE

CASE: 23586 **EPIZOO: INV NUM:** **7/21/2011**

Legal

FINDINGS TO DATE

Submitter: Tom Stehn Aransas NWR P.O. Box
100 1 Wildlife Circle Austwell, TX 77950

Specimen description/identification/Location: Date Submitted: 7/5/2011

ACC	SPECIES	SPECIMEN TYPE	BAND NUMBER	SUBMITTER's ID	COUNTY	STATE
001	Crane, Whooping	CARCASS	W4-11		Juneau	WI

Summary of Physical Characteristics

ACC	SEX	AGE	WEIGHT	BODY CONDITION	POSTMORTEM STATE
	Male	Nestling or suckling	2690 gm	Poor	Poor

Comment:

The whooping crane submitted from Necedah NWR was necropsied 7/19/11. There was extensive evidence of trauma. This nestling male crane had multiple puncture wounds in the left axilla and left lateral thorax and a single puncture wound to the posterior portion of the dorsal head. The right ulna was fractured with missing soft tissue around the fracture. Multiple ribs were fractured and luxated and the proximal thoracic vertebral column was transversely fractured at about T2 T3 which is probably the immediate cause of death.

There appears to be evidence of both predation (with puncture wounds and bite marks) as well as vehicular strike suspected to have caused the fractured thoracic vertebra.

Swabs and various tissue samples have been submitted for further tests. Results are pending. You will be notified of significant results. JLB

Anne E. Ballmann

If you have questions regarding this case, contact:

Anne E. Ballmann , DVM, Ph.D.
Wildlife Disease Specialist
Phone: 608-270-2445 **E-Mail:** aballmann@usgs.gov

Whooping Crane Chick W4-11 (July 1, 2011)

Appendix 3

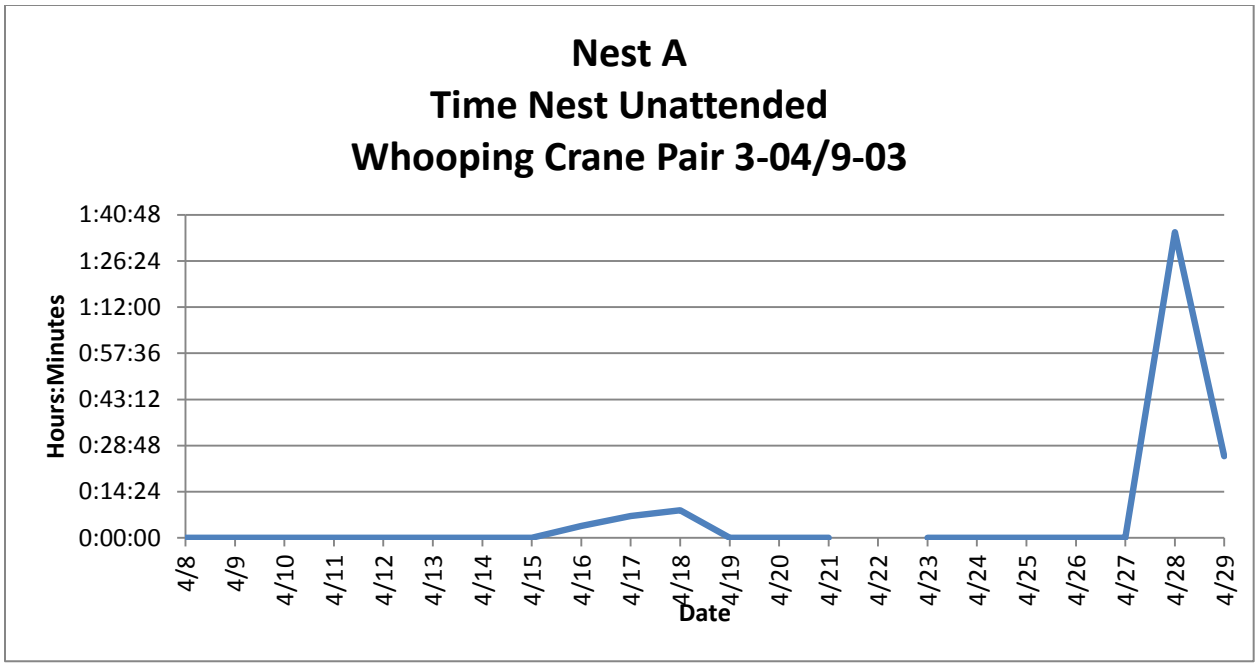
Nest Report for Whooping Crane Pair: 3-04/9-03

Previous nest attempts (with egg): 4 (before 2011)

History: This pair formed in 2008 and nested that year. The pair has nested together every year since that year.

2011 Nesting Season: The pair returned to Necedah NWR by March 18. The pair began a nest attempt on or about April 6. Two eggs were collected on April 30. A DVR surveillance camera was set up near the nest on April 9. Between April 9 and April 30, the pair left their nest unattended on at least 6 separate occasions during 5 different days. For any one day, the maximum time the nest was left unattended was at least 1 hour, 35 minutes, and 24 seconds. April 23 is missing video as the camera battery was dead for the duration of that day. The incubation lasted for approximately 24 days before it was interrupted. Black flies were observed in and around the nest during the April 30 visit. A decoy was deployed and run, and a picture of the nest was taken on April 30. No black flies were caught on the glueboard, and 22 flies were counted in the nest picture. The two salvaged eggs were transported to the International Crane Foundation and then to Patuxent Wildlife Research Center where the first egg hatched on May 4, and the second on May 5. The pair attempted one renest.

The pair began a second nest attempt on or about May 17. Two eggs were collected on May 28. A DVR surveillance camera was put up near the nest on May 18. Between May 18 and May 28, the pair left their nest unattended on at least 23 separate occasions during 11 different days. For any one day, the maximum time the nest was left unattended was at least 7 hours, 6 minutes, and 18 seconds on May 24, but may have been longer as the birds had not returned by nightfall, when video review stopped. The nest was also unattended for 4 hours, 9 minutes, and 18 seconds on May 28 before the eggs were salvaged. This incubation lasted 11 days before it was interrupted. Black flies were observed in and around the nest during the May 28 visit. A decoy was deployed and run, and a picture of the nest taken on May 28. Two black flies were caught on the glueboard, and 12 black flies counted in the nest picture. The glueboard sample was sent to Clemson University and the results are pending. The two salvaged eggs were transported to the International Crane Foundation and then transported to Patuxent Wildlife Research Center where the first egg hatched on June 15, and the second on June 17. The pair did not attempt a third nest.


Nest A
Time Nest Unattended
Whooping Crane Pair 3-04/9-03
Hours:Minutes
1:40:48
1:26:24
1:12:00
0:57:36
0:43:12
0:28:48
0:14:24
0:00:00
4/8
4/9
4/10
4/11
4/12
4/13
4/14
4/15
4/16
4/17
4/18
4/19
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4/21
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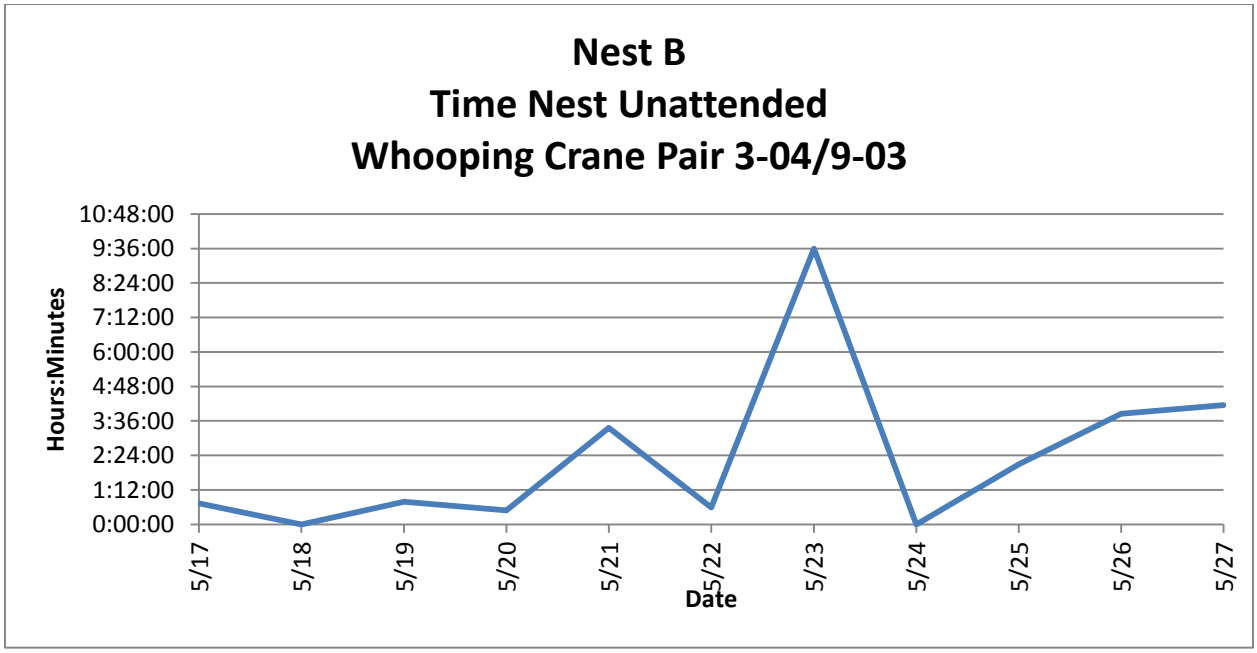
4/23
4/24
4/25
4/26
4/27
4/28
4/29
Date


Nest B
Time Nest Unattended
Whooping Crane Pair 3-04/9-03
Hours:Minutes
10:48:00
9:36:00
8:24:00
7:12:00
6:00:00
4:48:00
3:36:00
2:24:00
1:12:00
0:00:00
5/17
5/18
5/19
5/20
5/21
5/22
5/23
5/24
5/25
5/26
5/27
Date

Whooping Crane Nest A 3-04/9-03 (April 30, 2011)

Whooping Crane Nest B 3-04/9-03 (May 28, 2011)

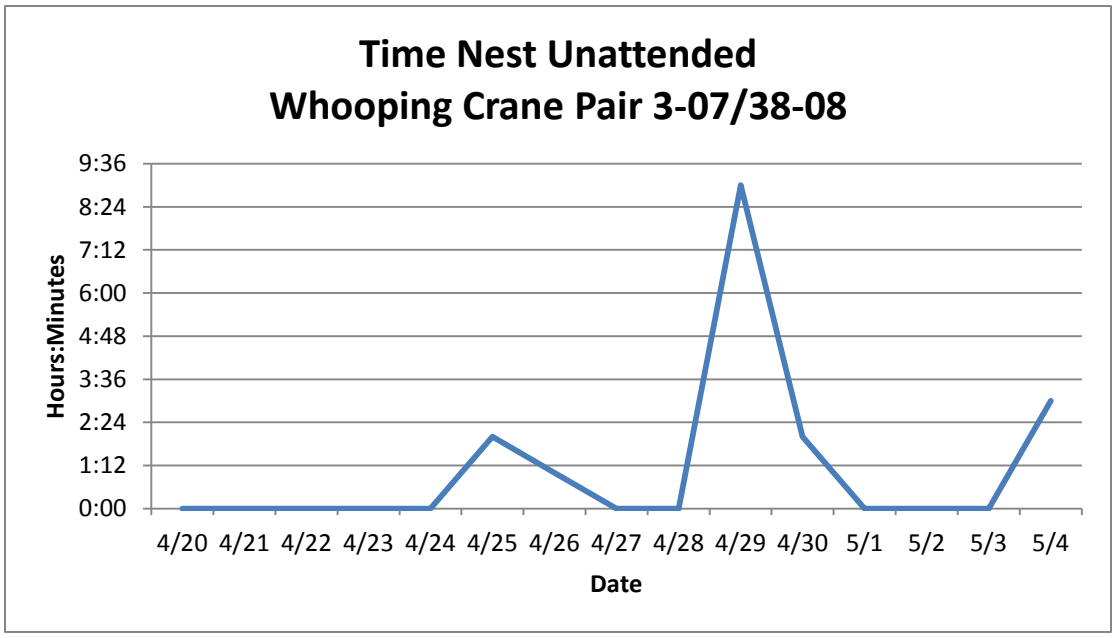
Appendix 4

Nest Report for Whooping Crane Pair: 3-07/38-08

Previous nest attempts (with egg): 0

History: This pair formed in 2011 and produced a nest and an egg that year.

2011 Nesting Season: The pair returned to Necedah NWR by March 19. The pair began a nest attempt on or about April 12. A nest camera was deployed on April 20. The last camera images of a bird on the nest were at 0900 on May 4. The last camera images of an egg on the nest were at 1200 on May 4. By 1300 on May 4 there was no egg on the nest. The nest was visited at approximately 1215 on May 5, at which time no egg(s)/egg fragments were found. Between April 20 and May 4, the pair left their nest unattended on at least 5 separate occasions during 5 different days. For any one day, the maximum time the nest was left unattended was at least 9 hours. This nest was likely left unattended for greater than 9 hours on April 29 because the nest was unattended at night fall (the time video review stopped) on April 29 but was attended at day break on April 30. Therefore, this figure is likely higher than approximately 9 hours unless the pair resumed incubation immediately after nightfall. This incubation lasted for approximately 22 days before it was interrupted. A nest picture was taken during the May 5 visit. No black flies were observed on or around the nest during this visit and none were counted in the nest picture. A crane decoy with glue board to collect black flies was not set-up. The pair did not attempt to renest.



Whooping Crane Nest 3-07/38-08 (May 5, 2011)

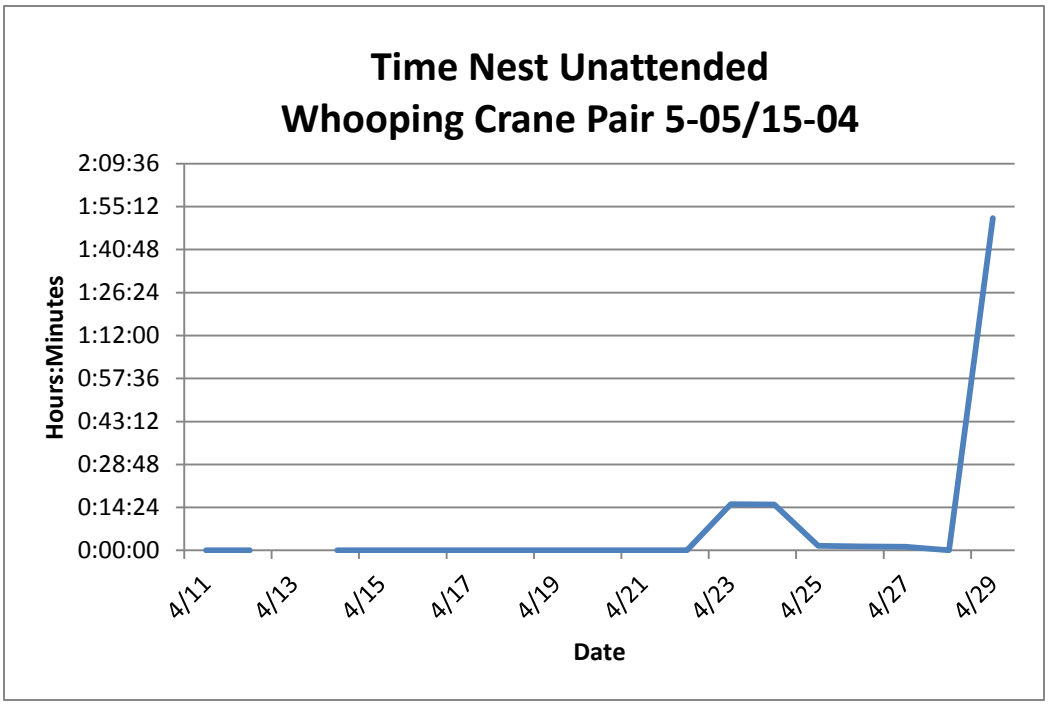
Appendix 5

Nest Report for Whooping Crane Pair: 5-05/15-04

Previous nest attempts (with egg): 3

History: This pair formed in 2008 and built a nest in that same year. They have built a nest each year since 2008.

2011 Nesting Season: The pair returned to Necedah NWR by March 11. The pair began a nest attempt on or about April 10. Nesting ended on April 29, and two eggs were collected on that day. The eggs were transported to the International Crane Foundation then shipped to Patuxent Wildlife Research Center. One egg hatched at the Patuxent Wildlife Research Center on May 11. A decoy was run at the nest sight on April 29 at about 1334, and 130 black flies were collected on the glueboard. The samples were sent to Clemson University for further analysis and results are pending. A high resolution picture was also taken at the same time, and revealed 97 black flies. A camera was set up near the nest on April 11. Between April 11 and April 29, the pair left their nest unattended on at least 12 separate occasions during 6 different days. For any one day, the maximum time the nest was left unattended was at least 1 hour, 51 minutes, and 23 seconds (April 29). On April 29 the pair was observed off the nest at 1125. When staff returned at 1330 the pair was still not seen and the eggs were collected. This incubation lasted for approximately 20 days before it was interrupted. There is no video data for April 13 due to equipment malfunction. The pair did not attempt to renest.



Whooping Crane Nest 5-05/15-04 (April 29,2011)

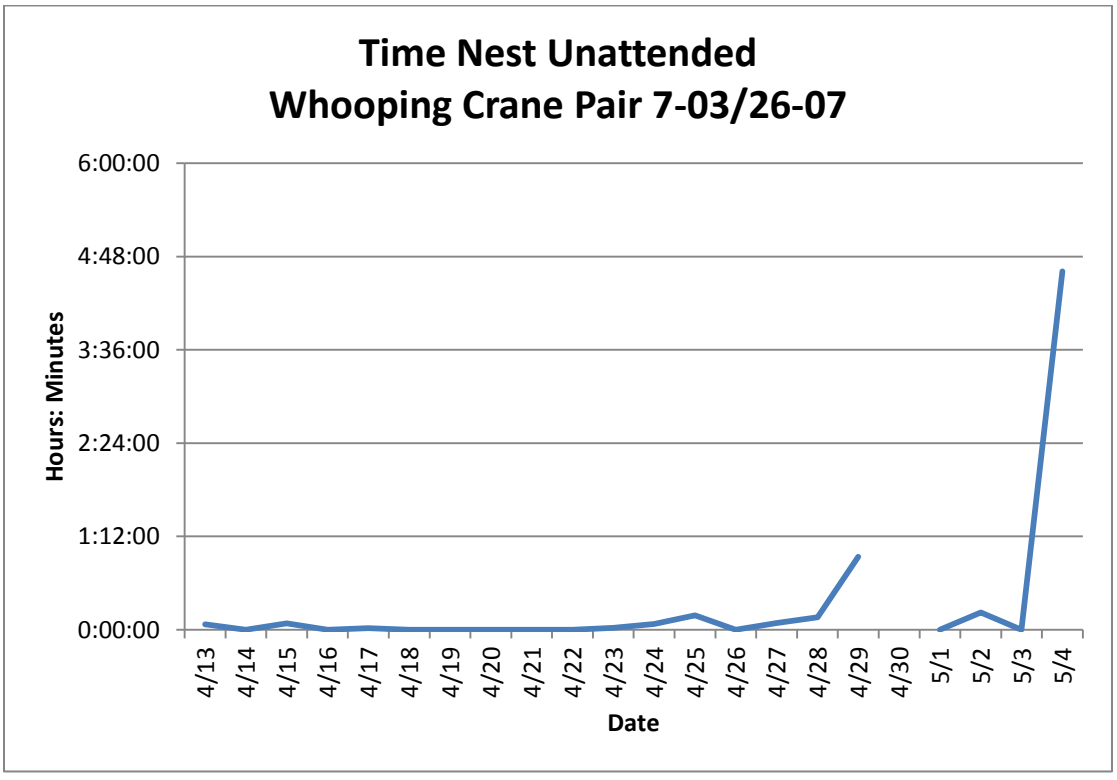
Appendix 6

Nest Report for Whooping Crane Pair: 7-03/26-07

Previous nest attempts (with egg): 0

History: This pair formed in 2011 and built a nest in that same year.

2011 Nesting Season: This pair returned to Necedah NWR by March 24. The pair was first observed nest building on April 3 and began a nest attempt on or about April 10. Nesting ended on May 4, and two eggs were collected on that day. The eggs were transported to the International Crane Foundation then to Patuxent Wildlife Research Center. The eggs hatched at Patuxent Wildlife Research Center on May 12 and May 14. A decoy was run at the nest on May 4, and 166 black flies were collected on the glueboard. The samples were sent to Clemson University for further analysis and the results are pending. A high resolution picture was also taken at this time and revealed 2,631 black flies. Between April 13 and May 4, the pair left their nest unattended on at least 20 separate occasions during 11 different days. For any one day, the maximum time the nest was left unattended was at least 4 hours, 36 minutes, and 34 seconds (May 4). This incubation lasted for approximately 25 days before it was interrupted. No video data was collected on April 30. The pair did not attempt to renest.



Whooping Crane Nest 7-03/26-07 (May 4, 2011)

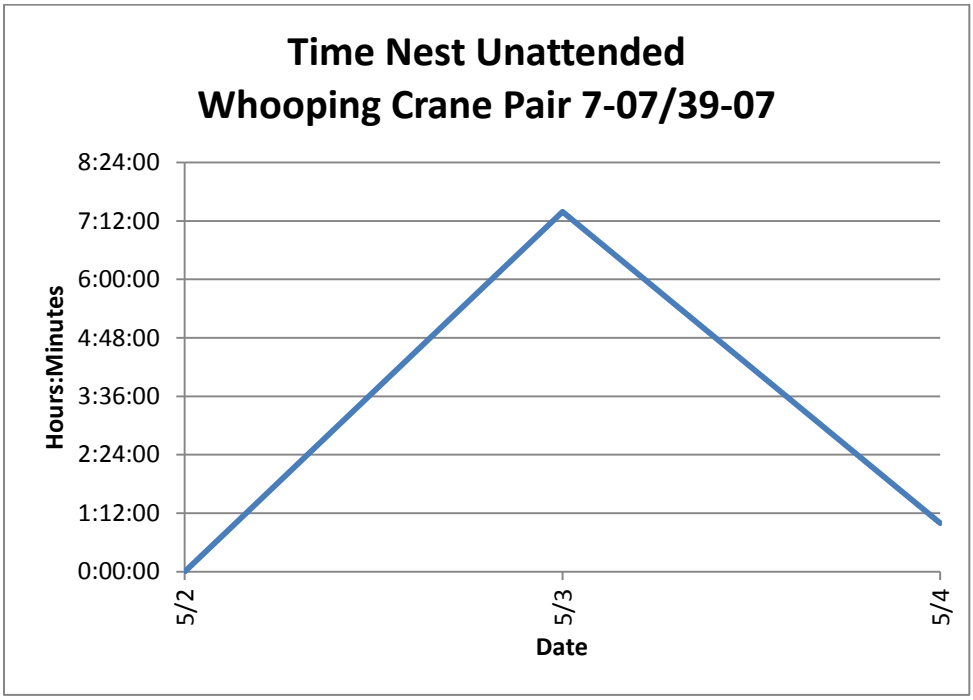
Appendix 7

Nest Report for Whooping Crane Pair: 7-07/39-07

Previous nest attempts (with egg): 0

History: This pair formed in 2011 and had not nested before.

2011 Nesting Season: The pair returned to Necedah NWR by March 18. The pair began a nest attempt on or about April 26. Two eggs were collected on May 5. A DVR surveillance camera was put up near the nest on May 3. Between May 3 and May 5, the pair left their nest unattended on at least 4 separate occasions during 2 different days. For any one day, the maximum time the nest was left unattended was at least 7 hours, 23 minutes, and 24 seconds on May 4, but may have been longer as the nest was unattended at nightfall, when the video review stopped. Necropsy results of both eggs are attached below. The results of the first necropsy indicated that there was no embryo, but the egg had possibly been fertile, and failed at approximately 2 days of development. The results of the second necropsy indicated that the egg was infertile. This incubation lasted for approximately 9 days before it was interrupted. Black flies were observed in and around the nest during the May 5 visit. A decoy was deployed and run, and a photo of the nest taken on May 5. No black flies were caught on the glueboard, and 3 black flies were counted on the photo of the nest. The pair did not attempt to renest.



Whooping Crane Nest 7-07/39-07 (May 5, 2011)

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP39-07A-11

Incubation initiation date: April 23, 2011

Date of Death: Unknown

Date of Necropsy: May 11, 2011

History: Retrieved from WCEP nest (39-07 & 07-07) 5 May @ 1100hr. Transferred to ICF 6 May. Weight at retrieval was 203.78g. Egg was determined to be addled, but possibly fertile.

Gross necropsy findings: Air cell membranes were cloudy upon entrance to egg. There was a strong odor. Liquid contents were mixed, and a dark mustard yellow, with flecks of orangish yolk and clearer albumen. There was no embryo present. However, there was one small vascular mass ~5mm diameter present. Liquid contents were retained for Hg testing; shell for further measurements.

Cultures submitted: None due to autolysis.

Tissues saved for histopathology: None due to autolysis.

Gross diagnosis: Possibly fertile, ~2d of development, significant autolysis.

Final diagnosis: (Possibly) fertile, early dead embryo of unknown cause.

Submitted by: Barry Hartup DVM, PhD

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP39-07B-11

Incubation initiation date: April 23, 2011

Date of Death: Unknown

Date of Necropsy: May 11, 2011

History: Retrieved from WCEP nest (39-07 & 07-07) 5 May @ 1100hr. Transferred to ICF 6 May. Weight at retrieval was 202g. Egg was determined to be infertile.

Gross necropsy findings: Air cell membranes were cloudy upon entrance to egg. The contents were consistent with an infertile egg, with distinct orangish yolk and clear albumen. Liquid contents were retained for Hg testing; shell for further measurements.

Cultures submitted: None.

Tissues saved for histopathology: None.

Gross diagnosis: Infertile egg, good quality.

Final diagnosis: Infertile egg.

Submitted by: Barry Hartup DVM, PhD

Appendix 8

Nest Report for Whooping Crane Pair: 8-04/19-05

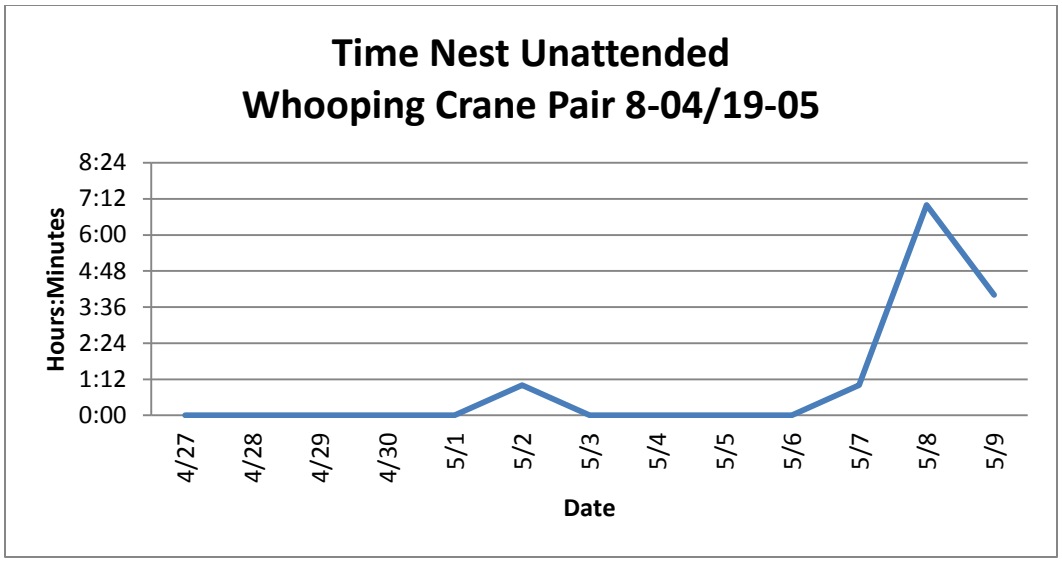
Previous nest attempts (with egg): 3

History: This pair formed in 2008 and built a nest in that same year. They have built a nest each year since 2008.

2011 Nesting Season: The male returned to Necedah NWR by March 29. The female returned separately on April 13. They began a nest attempt on or about April 25, and a nest camera was set up on April 27 at 2000. This camera was set up to take 30 pictures at the top of every hour. A review of the surveillance revealed the pair left the nest between 1300 and 1400 on May 8. The nest was visited at 1000 on May 9 after it was reported abandoned earlier that day. One egg with a small puncture wound was observed at this time. The egg was full of black flies. The damaged egg was not collected at this time because salvage equipment was not available. At approximately 1700 on May 9, the nest was re-visited. At this time, the nest contained no egg or egg shell fragments.

Between April 25 and May 9, the pair left their nest unattended on at least 4 separate occasions during 4 different days. For any one day, the maximum time the nest was left unattended was at least 7 hours. This nest was likely left unattended for greater than 7 hours on May 7/8 because the nest was unattended at night fall (the time video review stopped) on May 7 but was attended at day break on May 8. Therefore, this figure is likely higher than approximately 7 hours unless the pair resumed incubation immediately after nightfall. The nest was again left unattended for approximately 6 hours on May 8 and again for 4 hours on May 9 before the nest was visited by Necedah NWR staff. This nest was likely left unattended for greater than 6 and 4 hours on May 8/9 because the nest was unattended at night fall (the time video review stopped) on May 8 and was still unattended at day break on May 8.

The incubation lasted for approximately 14 days before it was interrupted. Black flies were observed in and around the nest and inside the egg on May 9. At 1700 on May 9, pictures of the nest were taken and a decoy was deployed. The egg observed at 1000 was no longer on the nest and was, therefore, not collected. One blackfly was collected on the glueboard, and 0 blackflies were counted from the nest picture. The black fly sample from the glue board was sent to Clemson University and the results are pending. The pair did not attempt to renest.



Whooping Crane Nest 8-04/19-05 (May 9, 2011)

Appendix 9

Nest Report for Whooping Crane Pair: 9-05/13-03

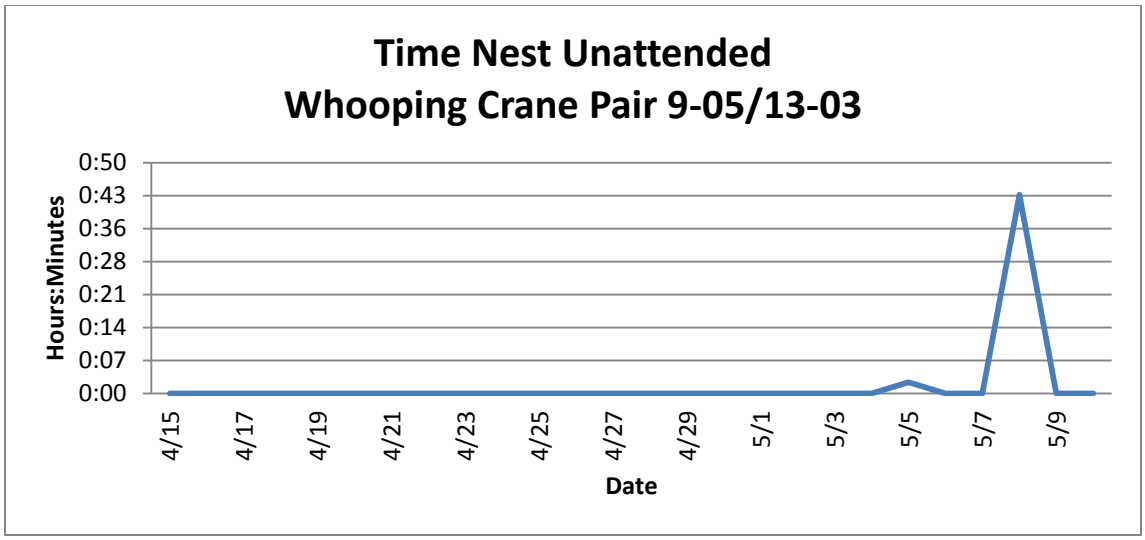
Previous nest attempts (with egg): 0

History: This pair formed in 2011 and built a nest in that same year.

2011 Nesting Season: The pair returned to Necedah NWR by March 25. The pair was first observed nest building on April 7 and began a nest attempt on or about April 10. A ditch plug was constructed in 2010 approximately 400 meters from the 2011 nest location. A nest camera was set up on April 15 at 1500, and replaced with a DVR surveillance camera near the nest on May 5 at 1311. The nest camera was set up to take 30 pictures at the top of every hour. One chick was observed on the nest on May 10 by a WI DNR pilot, but the family did not leave the nest until May 11 at 0542. Egg shell fragments from two eggs were collected at 1130 on May 11. Between April 10 and May 10, the pair left their nest unattended on at least 3 separate occasions during 2 different days. For any one day, the maximum time the nest was left unattended was at least 28 minutes and 36 seconds. On April 16, from 0800 to 1400, the nest was not visible due to fog, and on May 4, the camera stopped recording at 1445 and started again on May 5 at 1230. This loss of data was due to the battery dying before it was able to be changed. Finally, due to a shift in the camera position, the nest cannot be seen between 1343 and 1519 on May 9. Therefore, it is unknown if the nest was attended during these times.

A necropsy of the egg fragments is attached below. The results of the necropsy indicate two eggs were present in the nest. The second egg was confirmed to be fertile, but it is unclear if there was a successful hatching. No embryo was found. The second egg was predated/scavenged.

The incubation lasted for approximately 30 days before the chick(s) hatched. Black flies were observed in and around the nest during the May 11 visit. At 1130 on May 11, pictures of the nest were taken and a decoy was deployed. Egg shell fragments were also collected on this day. Fifty-six black flies were collected on the glueboard, and 130 black flies were counted from the nest picture. The black fly sample from the glue board was sent to Clemson University and the results are pending. After the pair's chick went missing (see chick report) the pair did not attempt to renest.



Whooping Crane Nest 9-05/13-03 (May 11, 2011)

Necropsy Report: WCEP NEST CONTENTS: 13-WCEP 13-03 A and B-11

Incubation initiation date: ~April 12, 2011

Date of Death: NA

Date of Necropsy: May 24, 2011

History: Materials retrieved from WCEP nest (9-05/13-03) 11 May. At least 1 chick hatched on May 10.

Gross necropsy findings:

Egg A: Width = 65.6mm. These remains are consistent with a hatched egg, with a consistent angle of defect and regular round opening, but the edge is jagged, at the large end of the egg.

Egg B: Length = 100.3mm.The remains consist of the length of an intact egg with a large, oval shaped opening along the long axis, exposing the bulk of the contents (see picture). There are multiple signs of trauma, with hemorrhages visible in tissue remains. There are urates mixed with other membranous internal structures. This egg was likely near hatching, but no portions of an embryo were found. 3 black flies were sampled and placed in alcohol (accidentally mixed with samples from egg #12-03A).

Cultures submitted: None.

Tissues saved for histopathology: NA.

Gross diagnosis: 2 eggs were present in this nest. Egg B was also fertile, and likely contained a near hatching embryo prior to predation.

Final diagnosis: 2 egg clutch; both eggs were fertile and resulted in 1 successful hatching. Egg B predated/scavenged.

Submitted by: Barry Hartup DVM, PhD

Appendix 10

Nest Report for Whooping Crane Pair: 10-03/W1-06

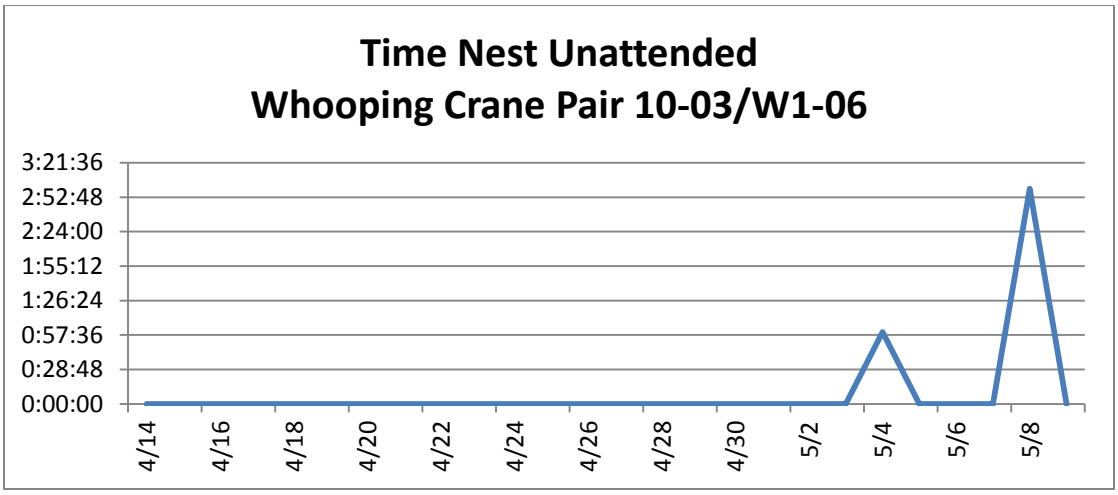
Previous nest attempts (with egg): 2

History: This pair formed in 2009 and built a nest in that same year. They have built a nest each year since 2009.

2011 Nesting Season: The pair returned to Necedah NWR by March 22. The pair began a nest attempt on or about April 9, and a nest camera was set up on April 14 at 1300. This camera was set up to take one picture every hour. One chick (W1-11) was observed on the nest on May 9. Egg shell fragments from two eggs were collected on May 10. Between April 9 and May 9, the pair left their nest unattended on at least 2 separate occasions during 2 different days. For any one day, the maximum time the nest was left unattended was at least 3 hours.

The nest pictures show one bird sitting on the nest at 0700 and one bird standing on the nest at 0800 on May 9. At 0900 on the same day, an image shows two birds in the nesting area but away from the nest. They both have their heads down in the same area. It is estimated that the pair left the nest with the chick at this time and that the chick had hatched slightly before this. Furthermore, images on May 10 at 0600 and 0700 show one bird sitting down while another bird stands nearby. It is estimated that the bird was brooding at this time. At 1000 on May 10, the family had moved away from the nest area, and the nest was visited. Nest pictures were collected at this time and a decoy/glueboard sample was collected. Egg shell fragments were also collected at this time.

A necropsy of the egg fragments is attached below. The results of the necropsy indicate two eggs were present in the nest and at least one egg hatched on May 9. The second egg was confirmed to be fertile, but it is unclear if there was a successful hatching. The incubation lasted for approximately 30 days before the chick(s) hatched. Black flies were observed in and around the nest during the May 10 visit. One black fly was collected on the glueboard, and 25 blackflies were counted from the nest picture. The black fly sample from the glue board was sent to Clemson University and the results are pending. The pair did not attempt to renest.



Whooping Crane Nest 10-03/W1-06 (May 10, 2011)

Necropsy Report: WCEP NEST CONTENTS: 13-WCEP W1-06 A and B-11

Incubation initiation date: ~April 8, 2011

Date of Death: NA

Date of Necropsy: May 24, 2011

History: Materials retrieved from WCEP nest (10-03/W1-06) 10 May. At least 1 chick hatched on May 9.

Gross necropsy findings: There are egg shell fragments in 2 large sections consistent with a large and small pole of an egg attached to inner shell membrane. There is also a large, intact section of membrane consistent with a small ½ of egg. All membranes show evidence of blood vessel development. Bits of vegetation are also observed as well as urates from chick waste.

Cultures submitted: None.

Tissues saved for histopathology: NA.

Gross diagnosis: Due to the presence of materials that account for 3 "poles" of eggs, it is believed that 2 eggs were present in this nest. The "second" egg was fertile, but it is unclear from the material present whether there was a successful hatching since only 1 chick was ever observed.

Final diagnosis: 2 egg clutch; both eggs were fertile and resulted in at least 1 successful hatching.

Submitted by: Barry Hartup DVM, PhD

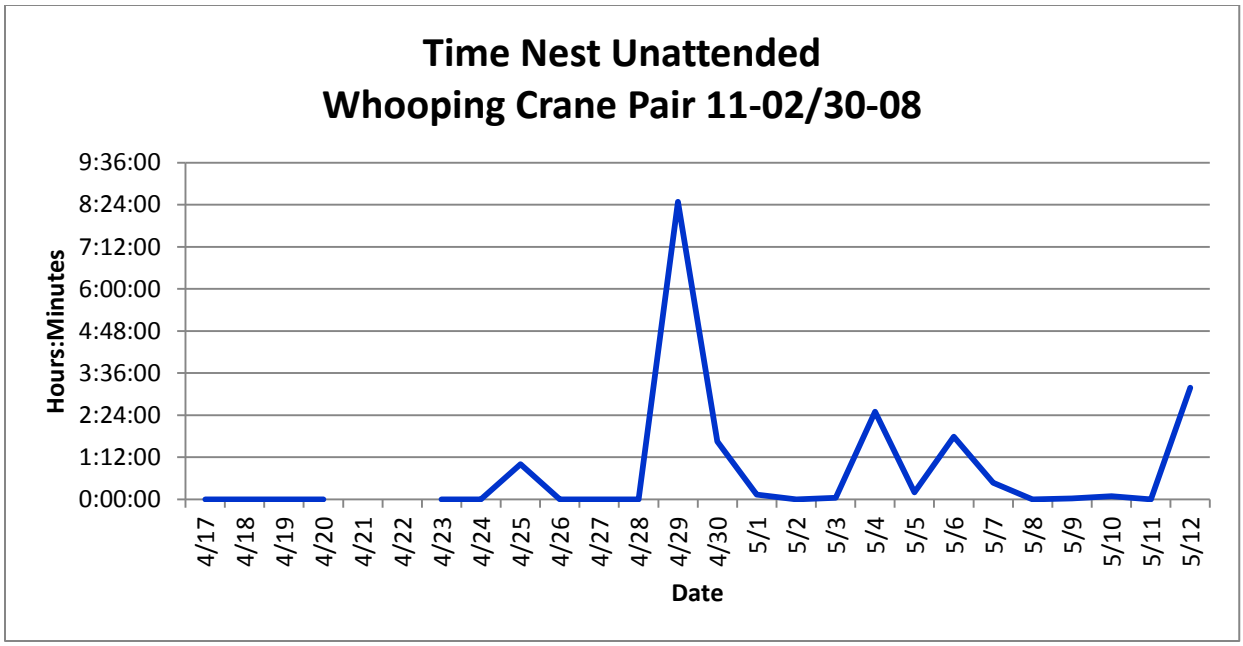
Appendix 11

Nest Report for Whooping Crane Pair: 11-02/30-08

Previous nest attempts (with egg): 0

History: This pair formed in 2010 and built a nest in that same year but did not lay an egg.

2011 Nesting Season: The pair returned to Necedah NWR by March 19. The pair was first observed nest building on April 7 and began a nest attempt on or about April 16. Nesting ended on May 12, and one egg was collected at 13:45 on that day. A nest camera was set up near the nest on April 17. On April 25 the camera was switched to a video surveillance camera (DVR). Between April 16 and May 12, the pair left their nest unattended on at least 32 separate occasions during 12 different days. For any one day, the maximum time the nest was left unattended was at least 8 hours, 29 minutes, and 10 seconds. An attempted egg salvage on this day (April 29) was cancelled when the pair exhibited aggressive behavior during the nest visit. This nest was likely left unattended for greater than 8 ½ hours on April 29/30 because the nest was unattended at night fall (the time video stopped) on April 29 but was attended at day break on April 30. Therefore, this figure is likely higher than approximately 8 ½ hours unless the pair resumed incubation immediately after nightfall. The nest was again left unattended for approximately 3 hours on May 12 when the egg was salvaged. A necropsy of the egg is attached below. The results of the necropsy indicated that the embryo died on approximately May 8. If the embryo died on May 8 it was not the result of the nest being left unattended during daylight hours (see Figure below). During daylight hours, the nest/egg was left unattended for 28 minutes and 33 seconds on May 7 and for 1 hour, 47 minutes, and 10 seconds on May 6. Assuming the necropsy and nest start date are accurate, the embryo survived being unattended for at least 8 hours and 29 minutes on April 29 (day 13 of incubation). This incubation lasted for approximately 26 days before it was interrupted. Black flies were observed in and around the nest during both the April 29 and May 12 visits. A decoy was not run at the nest because of aggression exhibited by the male whooping crane. A high resolution nest picture was taken and 149 black flies were counted. The pair did not attempt to renest.



Whooping Crane Nest 11-02/30-08 (May 12, 2011)

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP30-08A-11

Incubation initiation date: April 16, 2011
Date of Death: estimated May 8, 2011
Date of Necropsy: May 16, 2011

History: Retrieved from WCEP nest (11-02 & 30-08) 12 May since pair was determined to have abandoned nesting attempt. Volume at retrieval 175ml.

Gross necropsy findings: The egg had been entered by BT on 13 May and determined to be non-viable. The hole was taped shut. There is a slight odor to the egg. The air cell membrane was not usable for inspection due to prior entry. Reddish fluid surrounds embryo (amniotic sac); the yolk sac was intact. There was an autolyzed but intact embryo, measuring length = 105mm, body width = 17mm body width, head width = 12mm. The embryo had distinct lid openings at the eyes, was fully feathered with down, and had well developed limbs; the legs had distinct toes and nails. No outward visible abnormalities were observed. The liver, heart, kidneys, adrenals, gall bladder and spleen were all grossly normal. Possible female, but certainty is not good. Did not note any supercoiling of umbilicus or lesions consistent with any pathology. Age is consistent with ~22 days development. Contents were saved for Hg study, shell for further measurements.

Cultures submitted: None due to autolyzed state.

Tissues saved for histopathology: None due to autolyzed state.

Gross diagnosis: Embryo aged ~22 days based on development, unknown cause of death, likely incubation failure. The embryo was dead by several days prior to abandonment. Field notes or video may inform if there behavioral changes around May 8.

Final diagnosis: Late dead embryo, likely due to some form of incubation failure.

Submitted by: Barry Hartup DVM, PhD

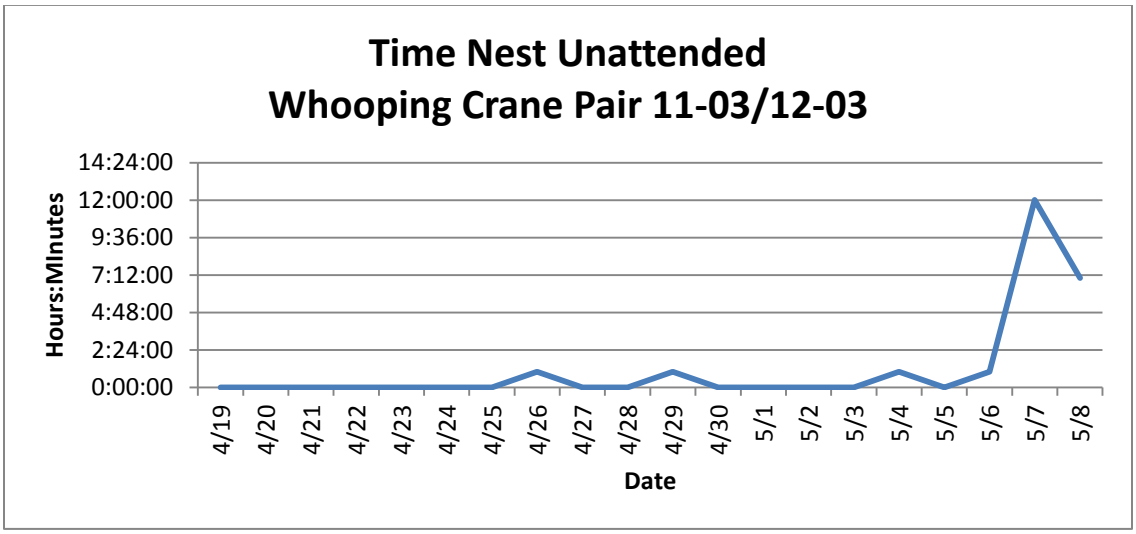
Appendix 12

Nest Report for Whooping Crane Pair: 11-03/12-03

Previous nest attempts (with egg): 3

History: This pair formed in 2008 and built a nest that same year. The pair has built a nest every year since 2008.

2011 Nesting Season: The pair returned to Necedah NWR by March 18. The pair began a nest attempt on or about April 15, but a camera was not placed near the nest until April 19 which is when video collection began. Two eggs were collected on May 8. Between April 15 and May 8, the pair left their nest unattended on at least 6 separate occasions during 6 different days. For any one day, the maximum time the nest was left unattended was at least 12 hours and 1 minute on May 7. This nest was likely left unattended for greater than 12 hours on May 7/8 because the nest was unattended at night fall (the time camera review stopped) on May 7 but was attended at day break on May 8. Therefore, this figure is likely higher than approximately 12 hours unless the pair resumed incubation immediately after nightfall. The nest was again left unattended on May 8 when the eggs were salvaged. A necropsy of both eggs is attached below. The results of the necropsy for both eggs indicate that the embryos died on approximately May 7 due to nest predation, most likely avian. Review of images from the nest camera did not show a predation event. However, only one picture was taken at the beginning of each hour throughout the day. This incubation lasted for approximately 24 days before it was interrupted. Black flies were observed in and around the nest during collection of the eggs on May 8. During the visit to the nest on May 8, a decoy was deployed and approximately 102 black flies were collected on the glueboard. A high resolution picture of the nest taken on May 8 revealed approximately 164 black flies. The black fly samples were sent to Clemson University and the results are pending. The pair did not attempt to renest.



Whooping Crane Nest 11-03/12-03 (May 8, 2011)

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP12-03A-11

Incubation initiation date: ~April 14, 2011
Date of Death: ~May 7, 2011 (3wk of development)
Date of Necropsy: May 24, 2011

History: Retrieved from WCEP nest (11-03/12-03) 8 May. Egg length x width: 107.79 x 66.78mm.

Gross necropsy findings: Remains are presented in a Ziploc bag, consisting of intact egg shell with large 3-4cm hole with irregular margins in large end of the egg and various liquid/solid contents. Remains consisted of thickened yellow yolk, albumen, inner egg shell membrane and various vascular-rich structures. There are no embryonic remains, but several down feathers are visible. Several black flies were collected in alcohol from the liquid and tissue contents.

Cultures submitted: None due to autolysis.

Tissues saved for histopathology: None due to autolysis and missing embryo.

Gross diagnosis: Fertile egg, with evidence of 3 week old embryo; likely predated.

Final diagnosis: Nest predation, likely avian. Due to feather development, embryo was at least 3 weeks of development.

Submitted by: Barry Hartup DVM, PhD

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP12-03B-11

Incubation initiation date: ~April 14, 2011
Date of Death: ~May 7, 2011 (3wk of development)
Date of Necropsy: May 24, 2011

History: Retrieved from WCEP nest (11-03/12-03) 8 May. Egg length x width: 107.8 x 64.1mm.

Gross necropsy findings: Remains are presented in a Ziploc bag, consisting of intact egg shell with large 3-4cm hole with irregular margins in large end of the egg and various liquid contents. Remains consisted of ~180ml of homogenous dark orange liquid (likely blood mixed with yolk) with clots of yolk. No tissues remain, but there were down feathers observed in the egg.

Cultures submitted: None due to autolysis/long storage.

Tissues saved for histopathology: None due to missing embryo.

Gross diagnosis: Fertile egg, with evidence of 3 week old embryo; likely predated.

Final diagnosis: Nest predation, likely avian. Due to feather development, embryo was at least 3 weeks of development.

Submitted by: Barry Hartup DVM, PhD

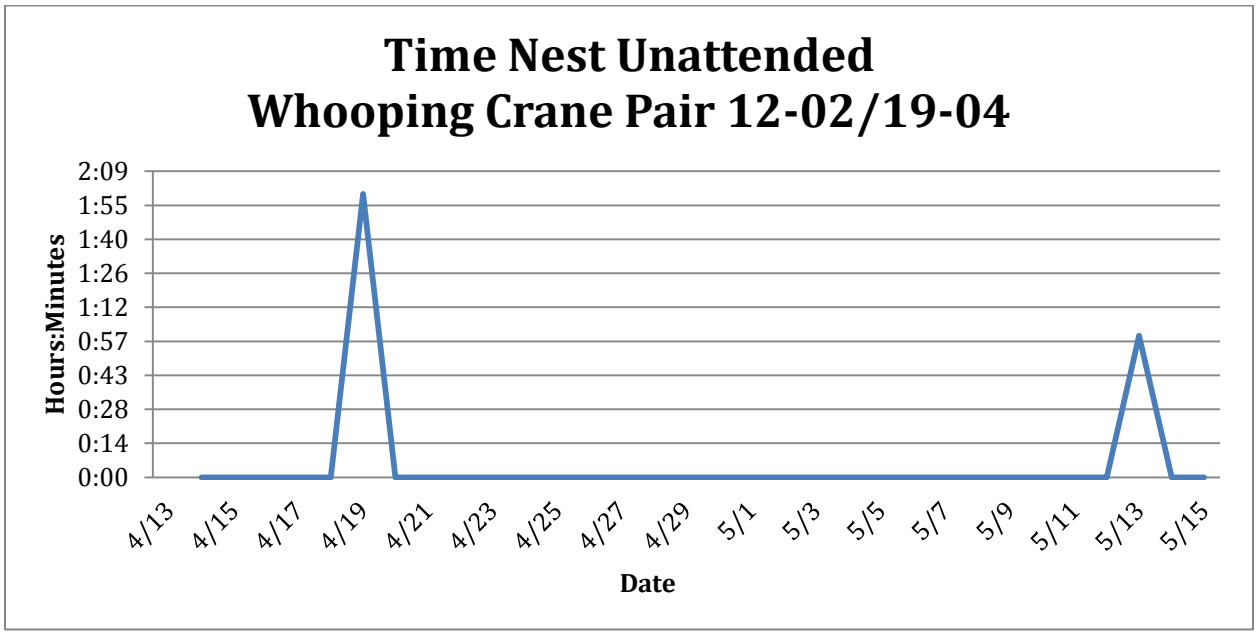
Appendix 13

Nest Report for Whooping Crane Pair: 12-02/19-04

Previous nest attempts (with egg): 5

History: This pair formed in 2008 and built a nest in the same year. The pair nested in 2009 and 2010.

2011 Nesting Season: The pair returned to Central Wisconsin by March 25. The pair began a nest attempt on or about April 13. A nest camera was deployed during April 14-May 15. The camera took one picture of the nesting area every hour from the hours 0500-2100. Between April 14 and May 15, the pair left their nest unattended on at least 2 separate occasions during 2 different days. For any one day, the maximum time the nest was left unattended was 2 hours. During daylight hours, the nest/egg was left unattended at 1600 and 1700 on April 19 and 0800 on May 13. On May 15 both eggs were salvaged. Necropsies of the eggs are attached below. The results of the necropsy indicated that the eggs were infertile. This incubation of infertile eggs lasted 32 days before it was interrupted. Black flies were not observed in and around the nest during the May 15 visit. Also on May 15, a glue board decoy was run and no black flies were sampled. A high-resolution image revealed 0 black flies. The pair did not attempt to renest.



Whooping Crane Nest 12-02/19-04 (May 15, 2011)

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP19-04A-11

Incubation initiation date: April 11, 2011
Date of Death: NA
Date of Necropsy: May 16, 2011

History: Retrieved from WCEP nest (12-02 & 19-04) 15 May since past predicted hatch date. Weight at retrieval was 199.63g. Volume = 180ml. Egg was determined to be infertile.

Gross necropsy findings: Contents were mixed (addled) with bright yellow yolk admixed throughout. Small amount of albumen seen. Noticeable poor odor. The contents were consistent with an infertile egg. Liquid contents were retained for Hg testing; shell for further measurements.

Cultures submitted: None.

Tissues saved for histopathology: None.

Gross diagnosis: Infertile egg.

Final diagnosis: Infertile egg.

Submitted by: Barry Hartup DVM, PhD

Necropsy Report: WCEP Whooping Crane Egg 13-WCEP19-04B-11

Incubation initiation date: April 11, 2011
Date of Death: NA
Date of Necropsy: May 16, 2011

History: Retrieved from WCEP nest (12-02 & 19-04) 15 May since past predicted hatch date. Weight at retrieval was 188.95g, volume = 175ml. Egg was determined to be infertile.

Gross necropsy findings: Air cell membrane was clear; contents were not mixed and there was distinct yolk and albumen in this infertile egg. Liquid contents were retained for Hg testing; shell for further measurements.

Cultures submitted: None.

Tissues saved for histopathology: None.

Gross diagnosis: Infertile egg.

Final diagnosis: Infertile egg.

Submitted by: Barry Hartup DVM, PhD

Appendix 14

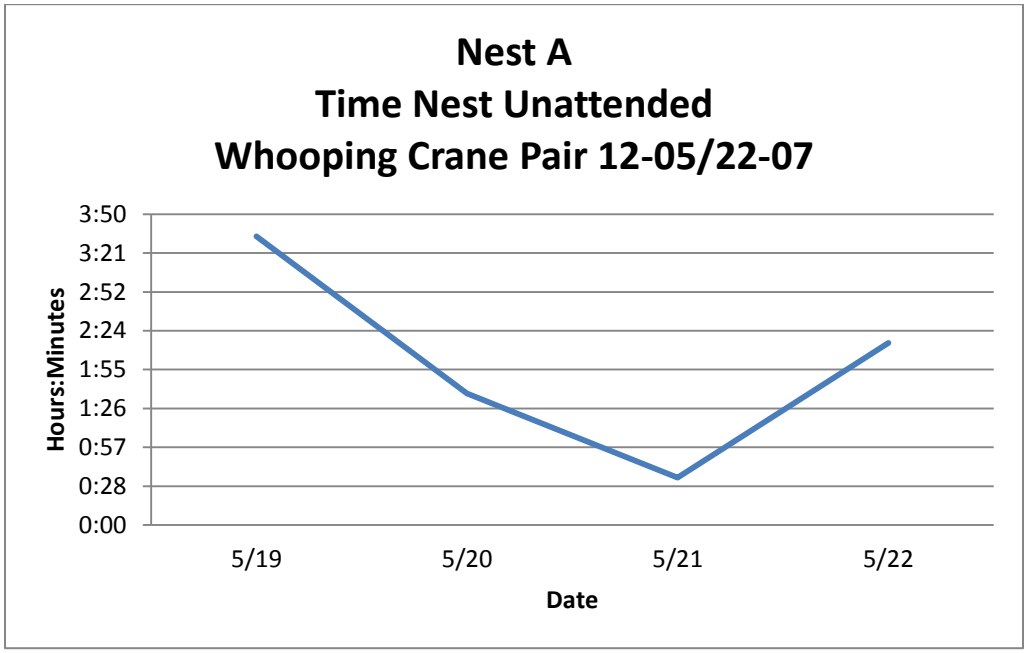
Nest Report for Whooping Crane Pair: 12-05/22-07

Previous nest attempts (with egg): 0 (before 2011)

History: This pair formed in 2011 and built two nests this current year.

2011 Nesting Season: The pair returned to Necedah NWR by March 19. The pair began a nest attempt on or about April 21. An egg salvage was attempted on April 26 but was cancelled when there was no route to nest without disturbing another, nearby, active pair. There was no telemetry signal for either bird on that day. There is no video data for the incubation period of April 21-23. A second egg salvage was conducted on April 29 when a route to the nest was discovered that would not disturb the nearby, active pair. Only egg fragments were found. Black flies were observed in and around the nest on this day. A glueboard decoy was run and 39 black flies were caught. This sample was sent to Clemson University and the results are pending. A high-resolution image revealed 4 black flies. This incubation lasted 3 days before it was interrupted.

The pair began a renest attempt on May 18, 25 days after first nest attempt. A camera was deployed on May 19 and the pair had one egg at that time. The time the nest was unattended during May 19-May 22 are shown in figure below. The pair left their nest unattended on at least 17 separate occasions during 4 different days. For one day the maximum time the nest was unattended was at least 3 hours and 34 minutes. On May 23 an attempted egg salvage occurred but no eggs or egg fragments were found. A glue board decoy was run and 1 black fly was caught. A high-resolution photo revealed 0 black flies. This incubation lasted 5 days before it was interrupted. A tornado passed through the nest area on May 22. There is no video data of the nest on May 23 due to the weather's effect on the equipment.



Whooping Crane Nest A 12-05/22-07 (April 29, 2011)

Whooping Crane Nest B 12-05/22-07 (May 23, 2011)

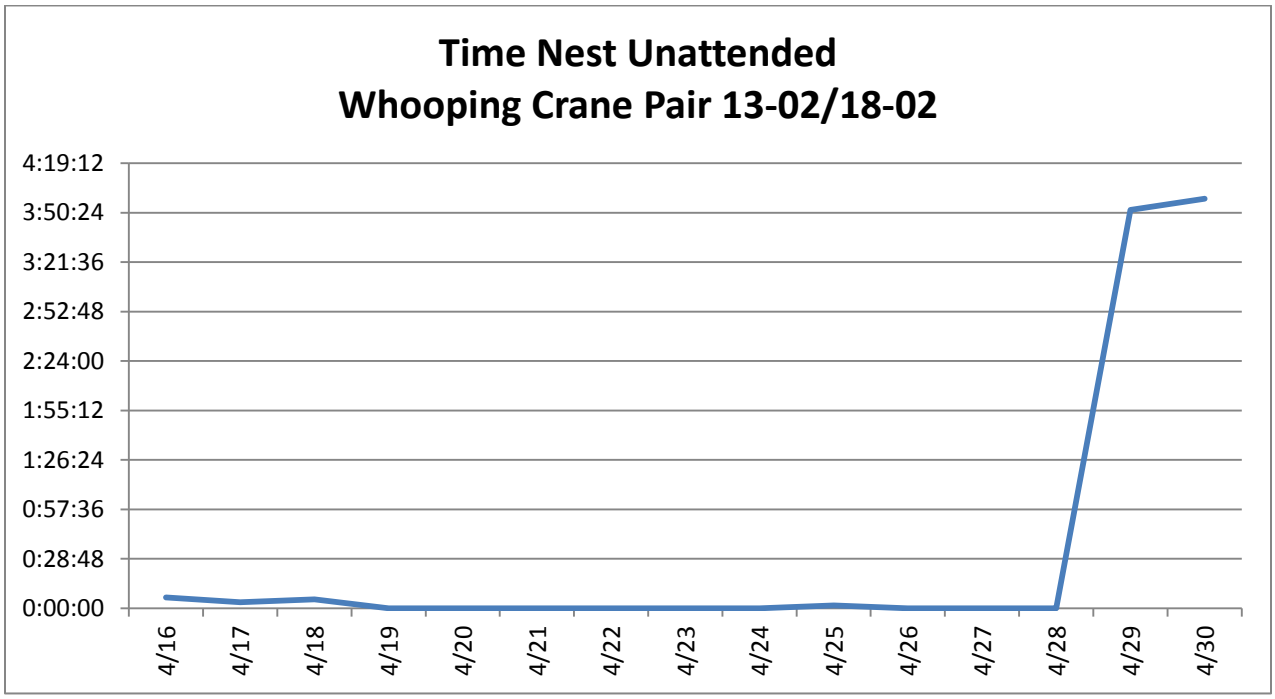
Appendix 15

Nest Report for Whooping Crane Pair: 13-02/18-02

Previous nest attempts (with egg): 6

History: This pair formed in 2006 and built a nest in the same year. The pair nested at least once every year since then.

2011 Nesting Season: The pair returned to Necedah NWR by March 19. The pair began a nest attempt on or about April 15. No eggs or egg fragments were found at the nest on April 30 when the pair abandoned. Between April 15 and April 30, the pair left their nest unattended on at least 25 separate occasions during 6 different days. For any one day, the maximum time the nest was left unattended was at least 3 hours, 58 minutes, and 35 seconds. The nest was left unattended for approximately 3 hours on April 30 when we attempted egg salvage. This incubation lasted 15 days before it was interrupted. The day the nest was abandoned there was no radio telemetry signal in the nest territory for the pair. Black flies were not observed in and around the nest during the April 30 visit; weather conditions were windy. A glue board decoy was run and no flies were captured on April 30. A high-resolution image revealed 0 black flies. The pair did not attempt to renest.



Whooping Crane Nest 13-02/18-02 (April 30, 2011)

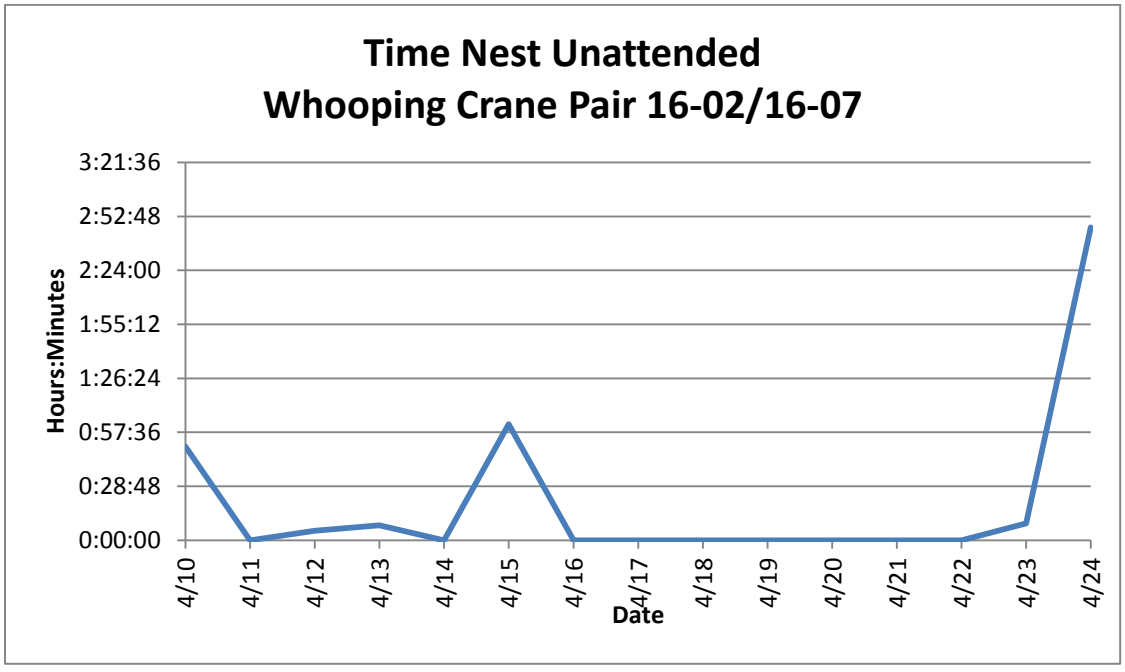
Appendix 16

Nest Report for Whooping Crane Pair: 16-02/16-07

Previous nest attempts (with egg): 0

History: This pair formed in 2011 and had not nested before.

2011 Nesting Season: The pair returned to Necedah NWR by March 19. The pair began a nest attempt on or about April 7. One egg was collected on April 24 at 2000. A DVR surveillance camera was placed near the nest on April 10. Between April 10 and April 24, the pair left their nest unattended on at least 9 separate occasions during 6 different days. For any one day, the maximum time the nest was left unattended was at least 1 hour, and 19 minutes. However, the camera battery died during the period in which the nest was unattended prior to the egg salvage. This period was at least 1 hour and 15 minutes, but may have been longer. The egg was salvaged an hour and a half after the battery died on April 24. The incubation lasted for approximately 17 days before it was interrupted. Black flies were observed in and around the nest on April 25. A decoy was deployed and run, and a photo taken of the nest on the same day. Twenty-one flies were caught on the glueboard, and 2 flies were counted in the nest picture. The glueboard sample was sent to Clemson University and the results are pending. The pair did not attempt to renest. The salvaged egg was transported to the International Crane Foundation and then transported to Patuxent Wildlife Research Center where it hatched on May 9.



Whooping Crane Nest 16-02/16-07 (April 25, 2011)

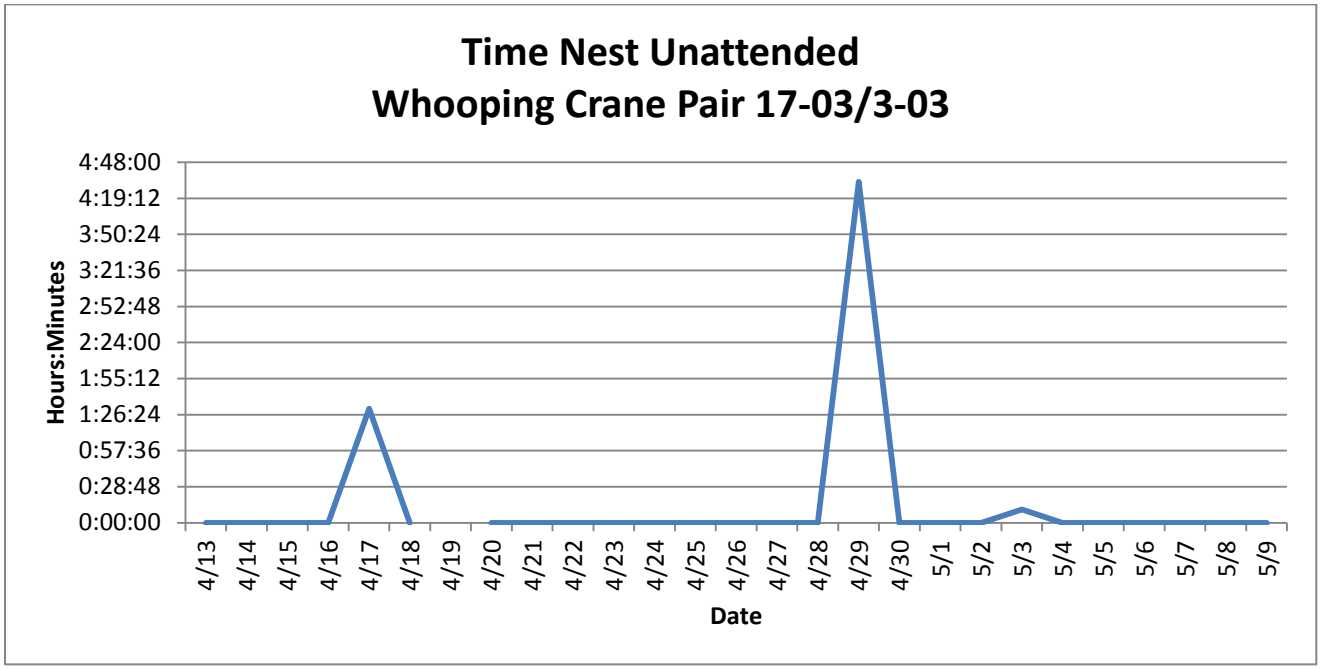
Appendix 17

Nest Report for Whooping Crane Pair: 17-03/3-03

Previous nest attempts (with egg): 8

History: This pair formed in 2007 and built a nest in that same year. This pair has built at least one nest every year since forming in 2007.

2011 Nesting Season: The pair returned to Necedah NWR by March 18. The pair began a nest attempt on April 9. One egg hatched approximately on May 9 (chick W2-11) and fragments of that egg (A) and of a second egg (B) were collected. A necropsy of egg B fragments is attached below. The pair began a nest attempt on April 9 but a camera was not placed near the nest until April 13 which is when video collection began. Between April 13 and May 9, the pair left their nest unattended on at least 4 separate occasions during 3 different days. For any one day, the maximum time the nest was left unattended was at least 4 hours, 32 minutes, and 31 seconds. The results of the necropsy indicated that both eggs were fertile and that the embryo from egg B was most likely scavenged and did not show evidence of hatching. This incubation lasted approximately 31 days. There is no video data available for April 19; this is most likely due to weather or equipment malfunction. Black flies were observed in and around the nest during the visit on May 11. During the visit to the nest on May 11, a decoy was deployed and approximately 50 black flies were collected on the glueboard. A high resolution picture of the nest taken on May 11 revealed approximately 13 black flies. Samples of black flies caught on the glueboard have been sent to Clemson University where they are awaiting analysis. After the pair's chick went missing (see chick report below) the pair did not attempt to renest.



Whooping Crane Nest 17-03/3-03 (May 9, 2011)

Necropsy Report: WCEP NEST CONTENTS: 13-WCEP 3-03 A and B-11

Incubation initiation date: ~April 8, 2011
Date of Death: NA
Date of Necropsy: May 24, 2011

History: Materials retrieved from WCEP nest (17-03/3-03) 11 May. At least 1 chick hatched on May 9.

Gross necropsy findings:
Egg A: Width = 63.9mm. These remains are consistent with a hatched egg, with a consistent angle of defect and regular round opening, but the edge is jagged, at the large end of the egg.
Egg B: The remains consist of the small ½ of the egg that were crushed, resulting in large shell fragments held together by the inner shell membrane. Additional shell membrane at the large end of the egg remains, extending to the rounded end. The border of the membrane is smooth and the opening is irregular in shape. There are blood vessels visible in the membrane.

Cultures submitted: None.

Tissues saved for histopathology: NA.

Gross diagnosis: 2 eggs were present in this nest. Egg B was also fertile, but shows no clear evidence of hatching. Egg B may have been predated/scavenged.

Final diagnosis: 2 egg clutch; both eggs were fertile and resulted in 1 successful hatching.

Submitted by: Barry Hartup DVM, PhD

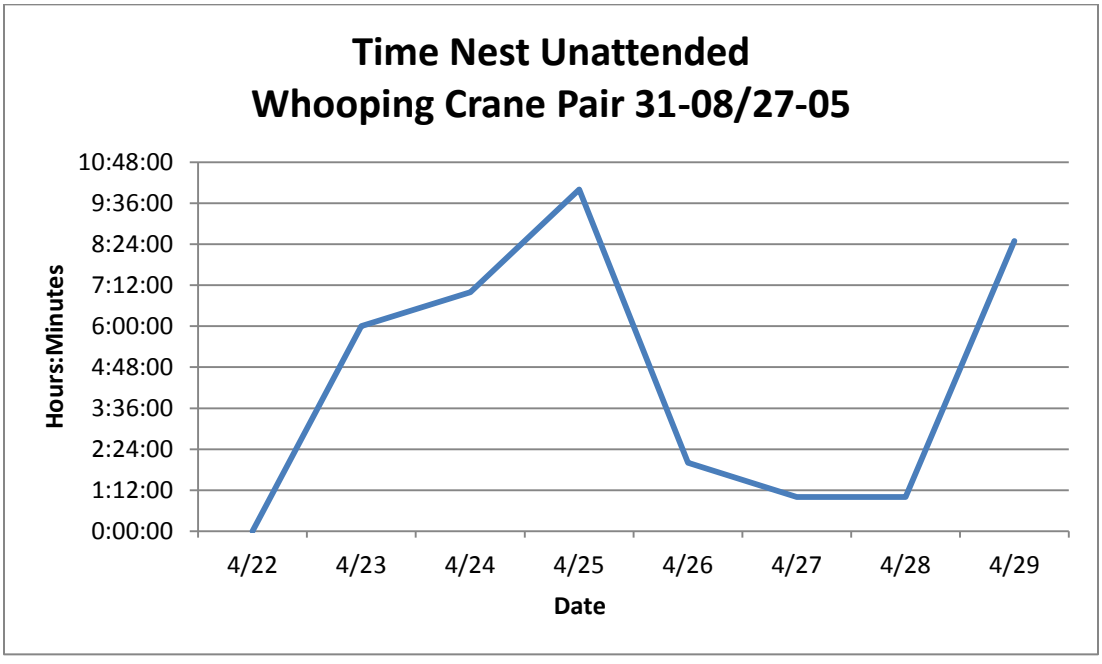
Appendix 18

Nest Report for Whooping Crane Pair: 31-08/27-05

Previous nest attempts (with egg): 0

History: This pair formed in 2011 and produced a nest and an egg that year.

2011 Nesting Season: The pair returned to Necedah NWR by March 19. The pair began a nest attempt on or about April 19. A nest camera was deployed at approximately 1200 on April 21, after the nest was located. Incubation resumed at 0900 on April 22. One egg was collected on April 29. The egg was later transferred to International Crane Foundation then to Patuxent Wildlife Research Center where it hatched on May 23. Between April 22 and April 29, the pair left their nest unattended on at least 11 separate occasions during 7 different days. For any one day, the maximum time the nest was left unattended was at least 10 hours. This nest was likely left unattended for greater than 10 hours on April 25 because the nest was unattended at night fall (the time video review stopped) on April 25 but was attended at day break on April 26. Therefore, this figure is likely higher than approximately 10 hours unless the pair resumed incubation immediately after nightfall. The nest was again left unattended for at least 8.5 hours on April 29 until the nest was visited by Necedah NWR staff at 1830 and the egg was salvaged. This incubation lasted for approximately 11 days before it was interrupted. A crane decoy with glueboard was deployed and a nest pictures was taken during the April 29 visit. Black flies were observed in and around the nest during the visit. Twenty four black flies were collected from the glue board and sent to Clemson University for analysis. Thirty three black flies were counted in the nest picture. The pair did not attempt to renest.

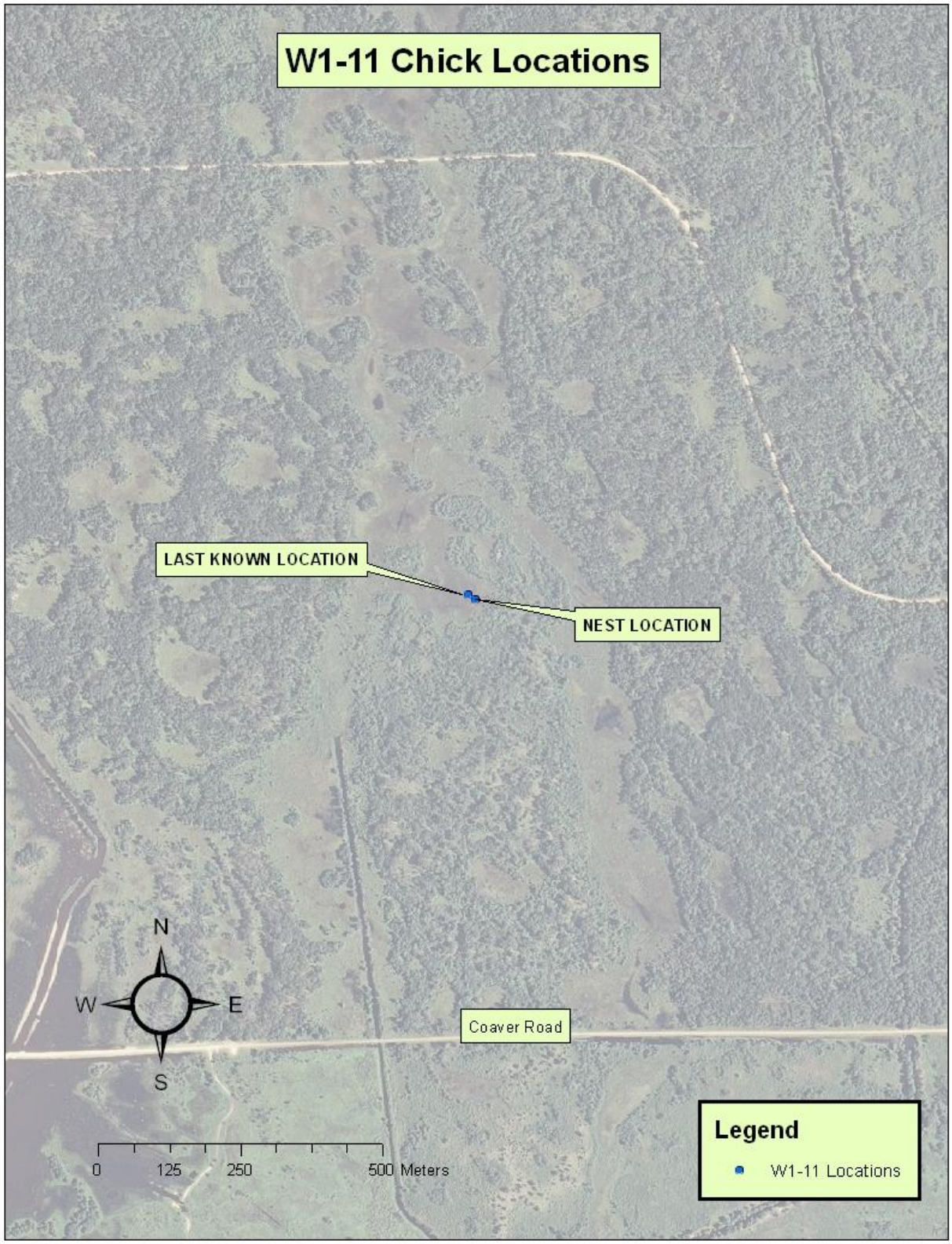


Whooping Crane Nest 31-08/27-05 (April 29, 2011)

Appendix 19

Report For Whooping Crane Chick: W1-11

A review of nest images indicates that chick W1-11 hatched to Whooping Crane pair 10-03/W1-06 between 0800 and 0900 on May 9. Chick mortality was suspected on May 10 at 1150. At this time the pair was seen foraging together near Upper Rice Pool, several hundred meters from the nest, without a chick**.** Fragments for two fertile eggs were collected from the nest; however it is unclear if the second egg hatched. The distance between the two known chick locations is 15.26 meters. If approximate hatch and death date are correct the chick survived two days.

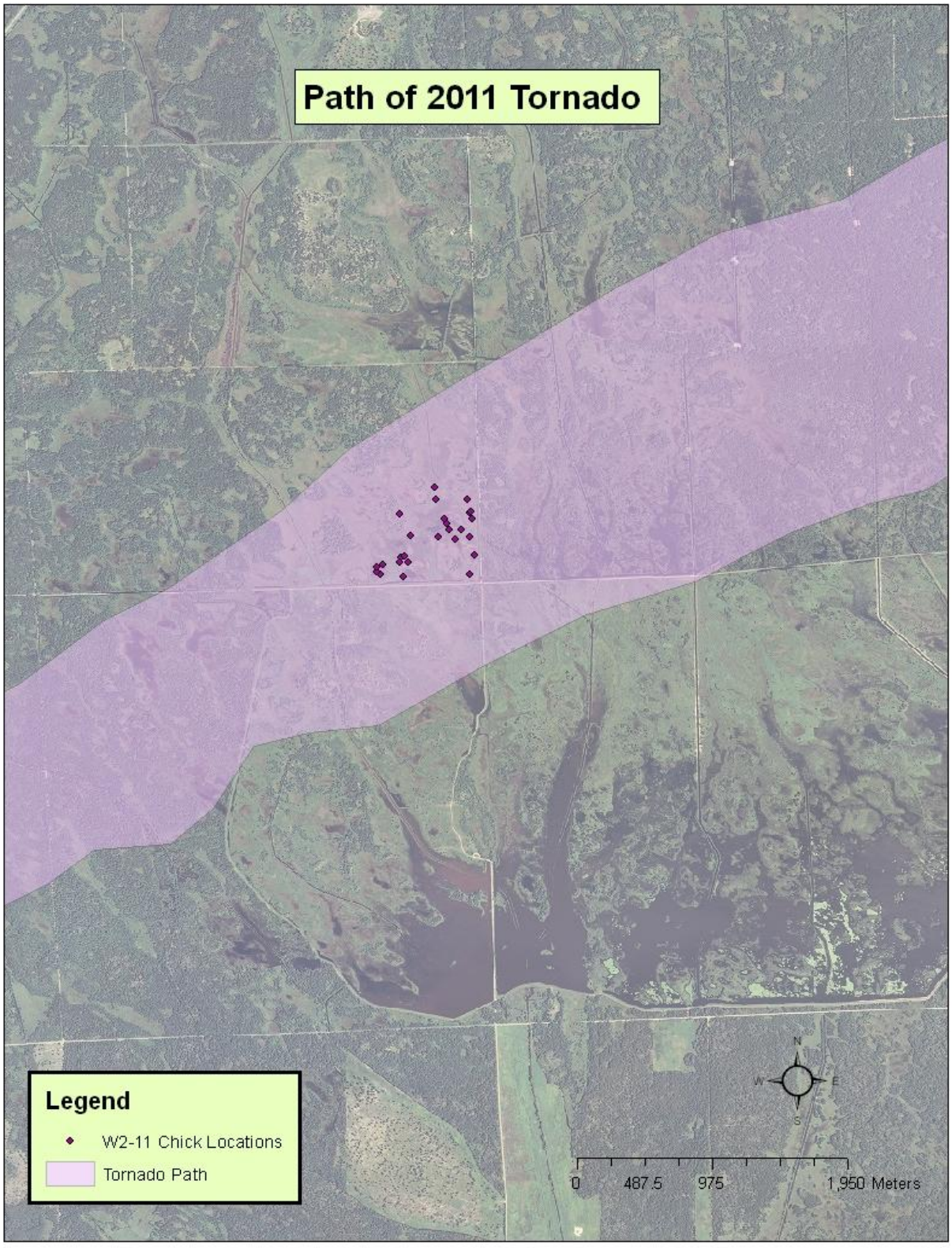

W1-11 Chick Locations
LAST KNOWN LOCATION
NEST LOCATION
N
W
E
S
Coaver Road
0
125
250
500 Meters
Legend
W1-11 Locations

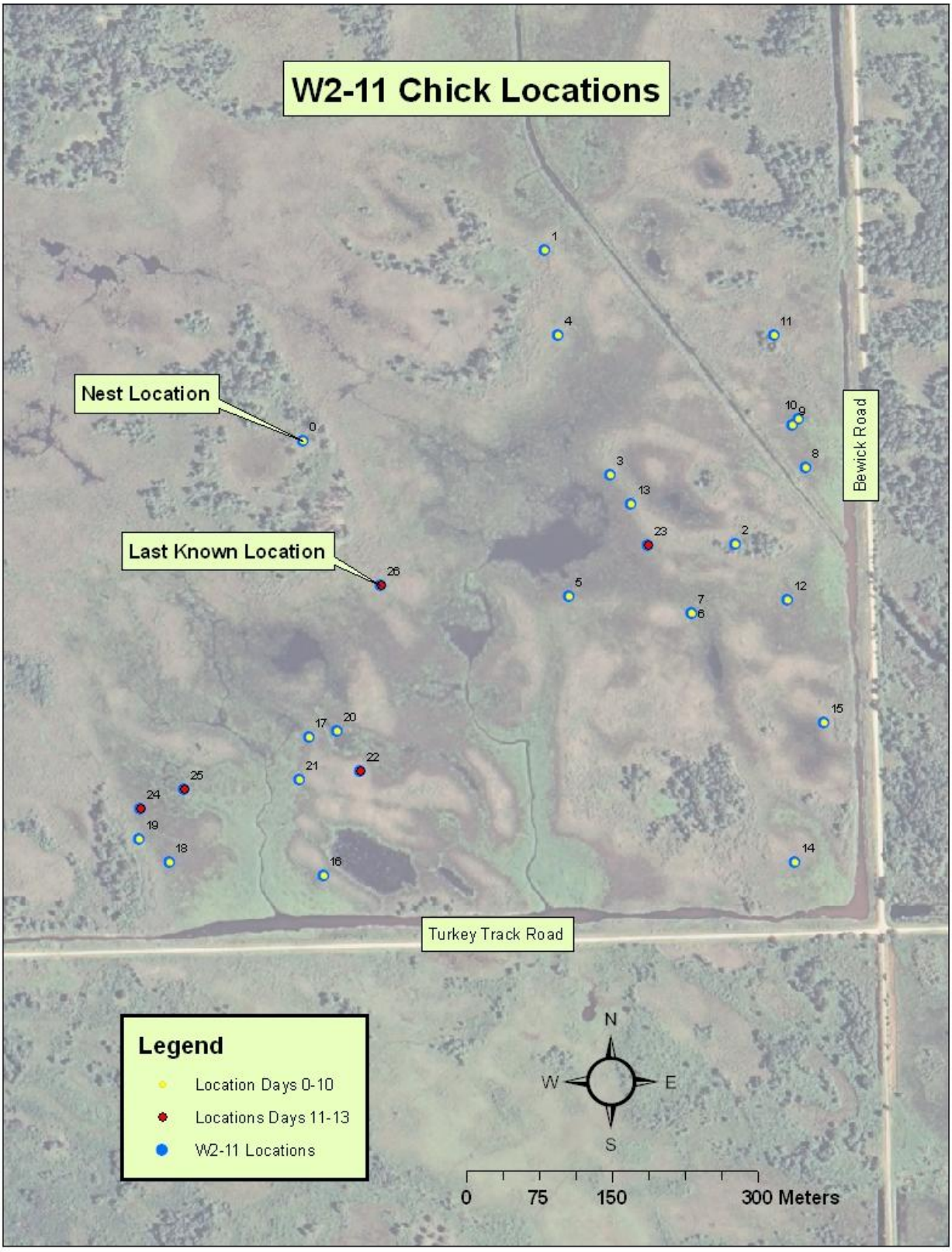
Appendix 20

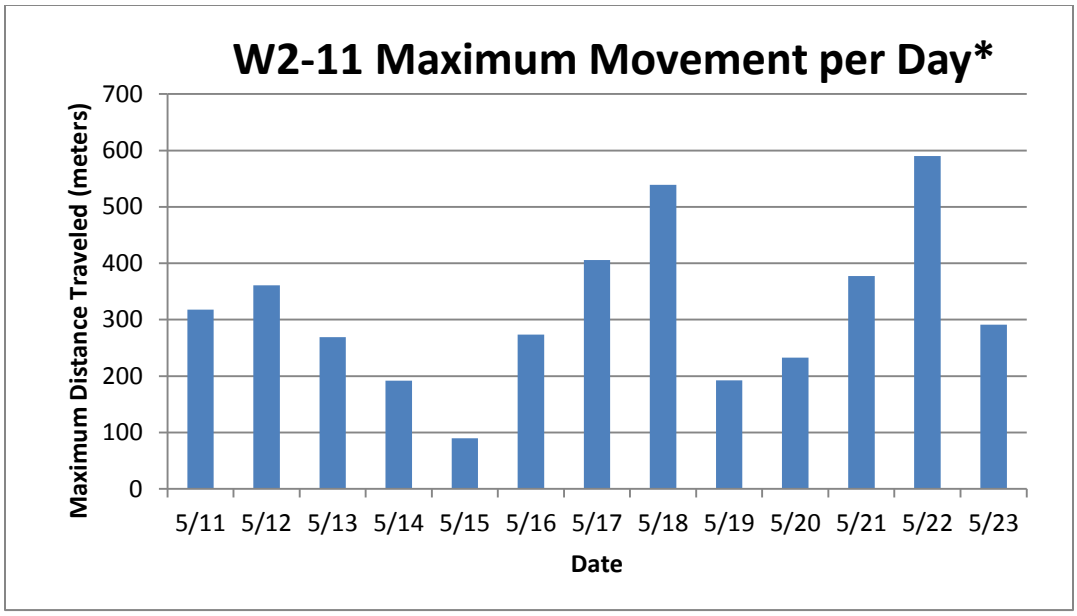
Report for Whooping Crane Chick: W2-11

The whooping crane pair 17-03/3-03 laid two eggs. Chick W2-11 hatched on approximately May 9. The second egg did not hatch and was most likely scavenged according to the necropsy report. On May 23 chick mortality was suspected when the adults were observed foraging without the chick. The chick was last seen the morning of May 22. On May 24 a search consisting of 3 people was conducted. It lasted over two hours and thirty minutes. The searchers moved over the territory in a grid-like pattern, however no body was found. From May 23 to May 27 the adults were seen repeatedly without a chick, after which monitoring was discontinued. Severe weather occurred the night of May 22 and may have contributed to chick mortality (see Path of Tornado Picture below). If the approximate hatch/mortality dates are accurate the chick survived for 13 days. In the first ten days of the chick's life, it traveled an average distance of 187.5 meters per observation. In the last three days of its life the chick traveled an average distance of 274.5 meters per observation (see graphs below). The longest distance the chick traveled between observations was 589.9 meters. These locations cover an area of approximately 30.8 hectares.

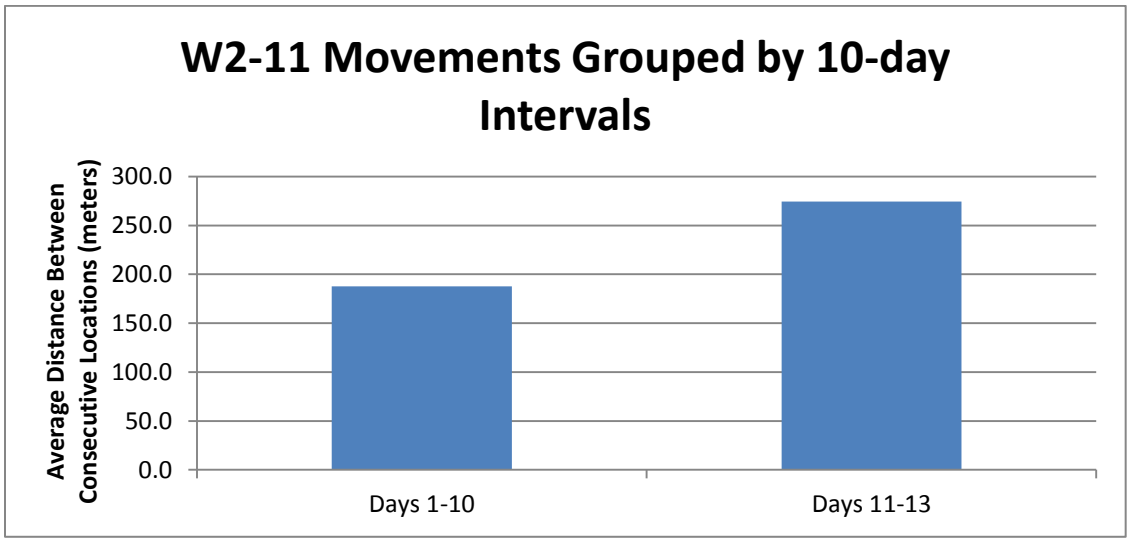
Path of Tornado on May 22




W2-11 Chick Locations
Nest Location
Last Known Location
Bewick Road
Turkey Track Road
Legend
Location Days 0-10
Locations Days 11-13
W2-11 Locations
N
W
E
S
0
75
150
300 Meters



* For days with multiple observations, the greatest distance traveled was used for this graph.

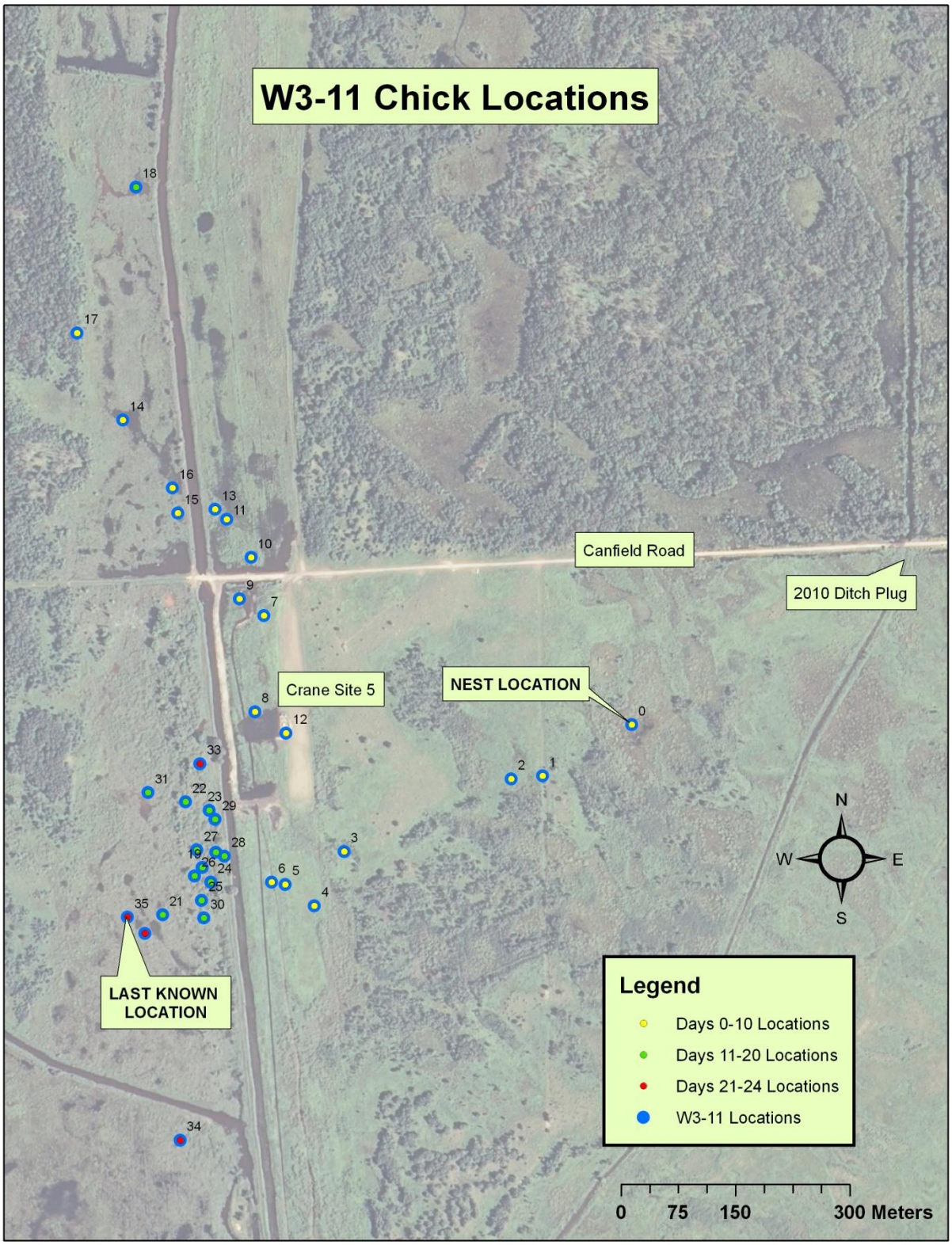


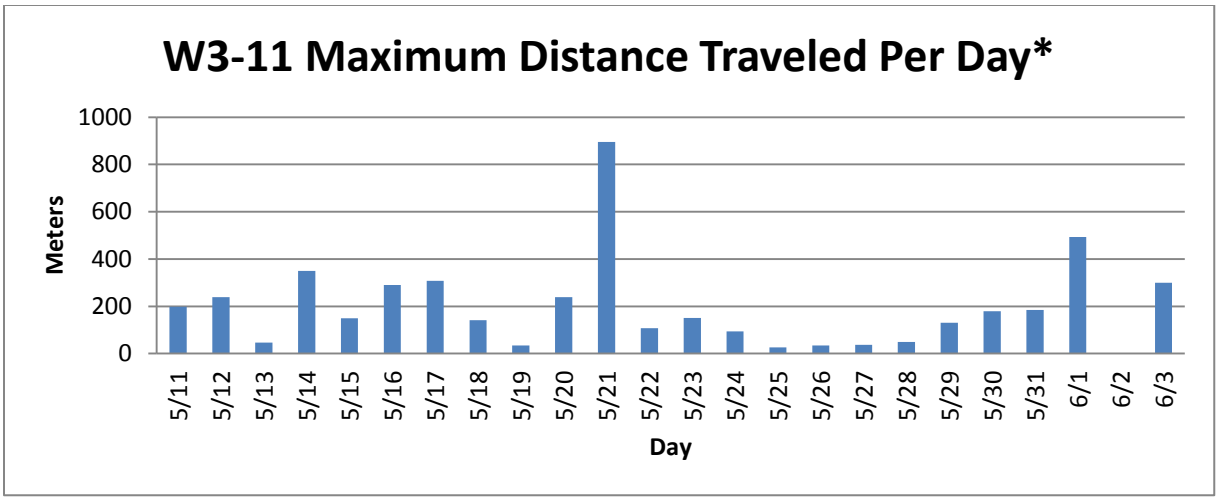
Appendix 21

Report for Whooping Crane Chick: W3-11

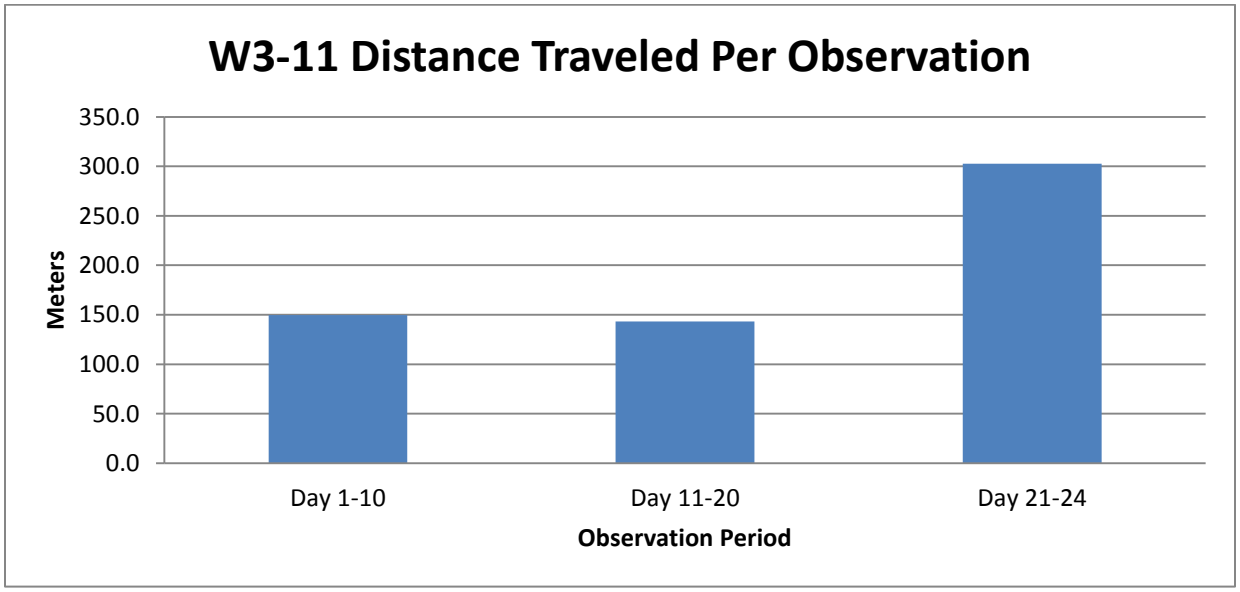
Whooping crane pair 9-05/13-03 hatched chick W3-11 approximately on May 10. The last visual on the chick was June 1, and June 3 was the last day evidence of a chick was observed. This chick survived 24 days if approximate dates (May 10-June3) are correct. Several observations occurred during June 4-June 7 where chick status was questionable. The crane family was located in thick vegetation with thick willow during those days. Determining chick status during those days was difficult. On June 8, staff confirmed that a chick was not present when the male was observed taking flight. No body was found and cause of death is unknown. The chick traveled an average of 203 meters per day. The longest distance traveled in one day was at least 895 meters (see graphs below). During the chick's first 10 days, it traveled an average of 150 meters per observation. On days 11-20 the chick traveled an average of 143 meters between observations and on days 21-24 the chick traveled an average of 303 meters. The chick traveled a minimum of 5,760 meters over its lifetime. Its locations covered approximately 17 hectares. There was no observation on June 2.

Whooping Crane Chick W3-11 (May 27, 2011)


W3-11 Chick Locations
Canfield Road
2010 Ditch Plug
Crane Site 5
NEST LOCATION
LAST KNOWN LOCATION
N
W
E
S
Legend
Days 0-10 Locations
Days 11-20 Locations
Days 21-24 Locations
W3-11 Locations
0 75 150 300 Meters



* For days with multiple observations, the greatest distance traveled was used for the above graph.

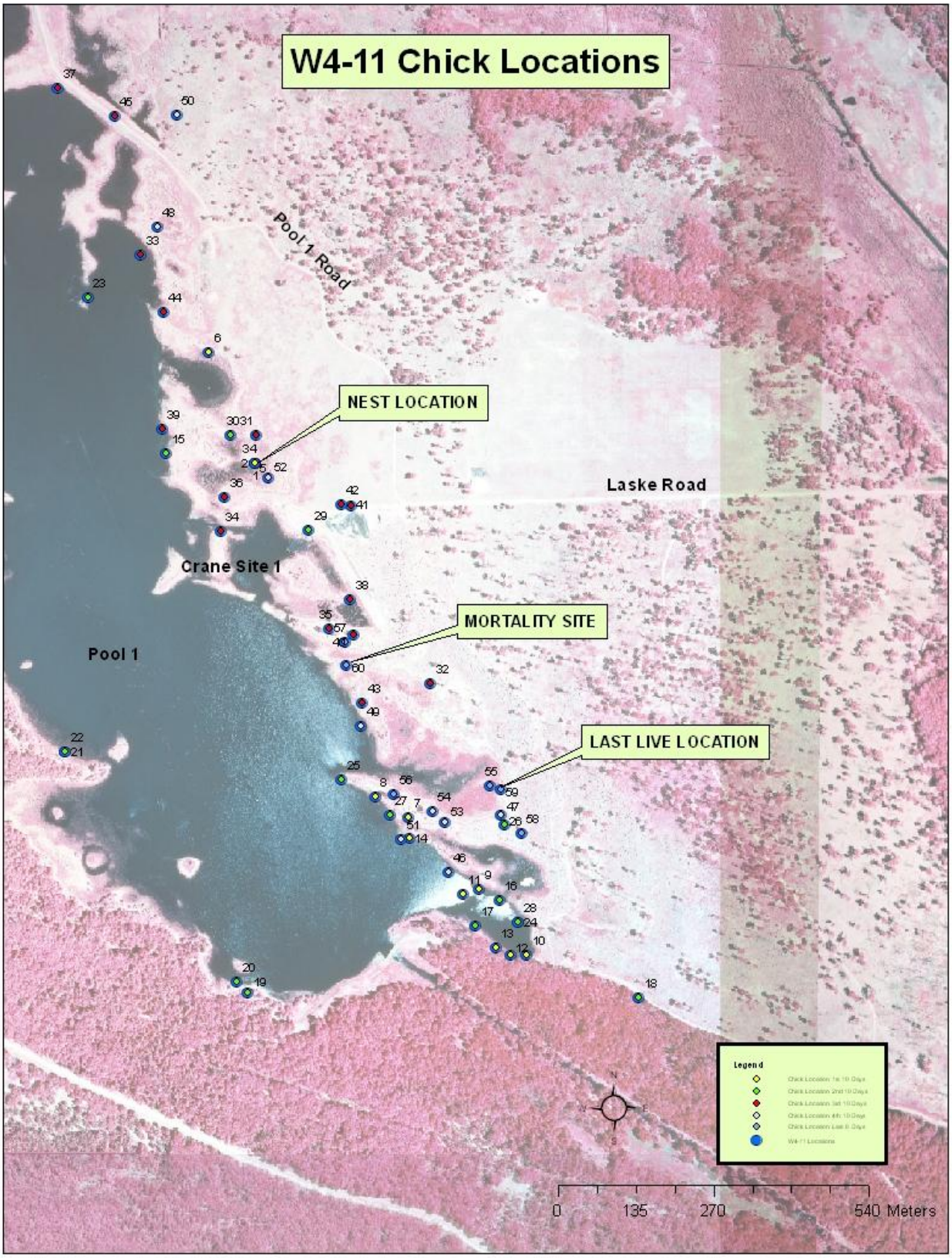


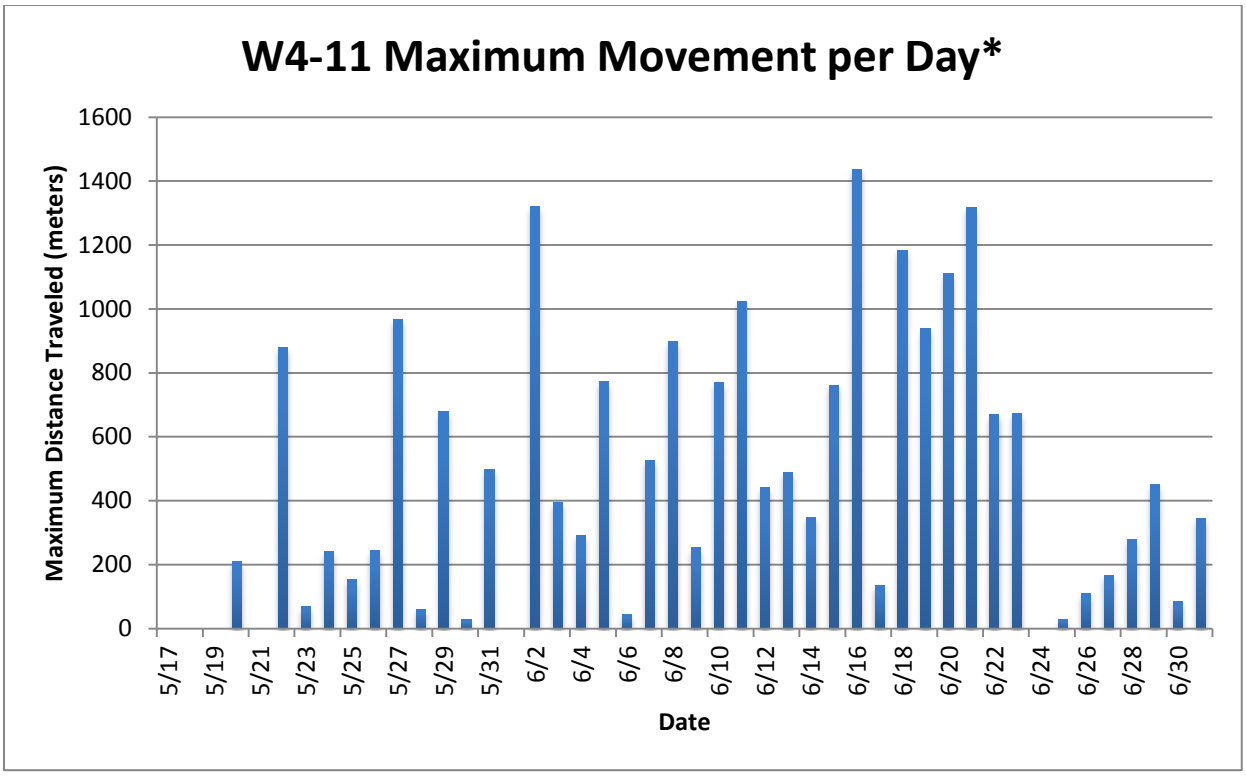
Appendix 22

Report for Whooping Crane Chick: W4-11

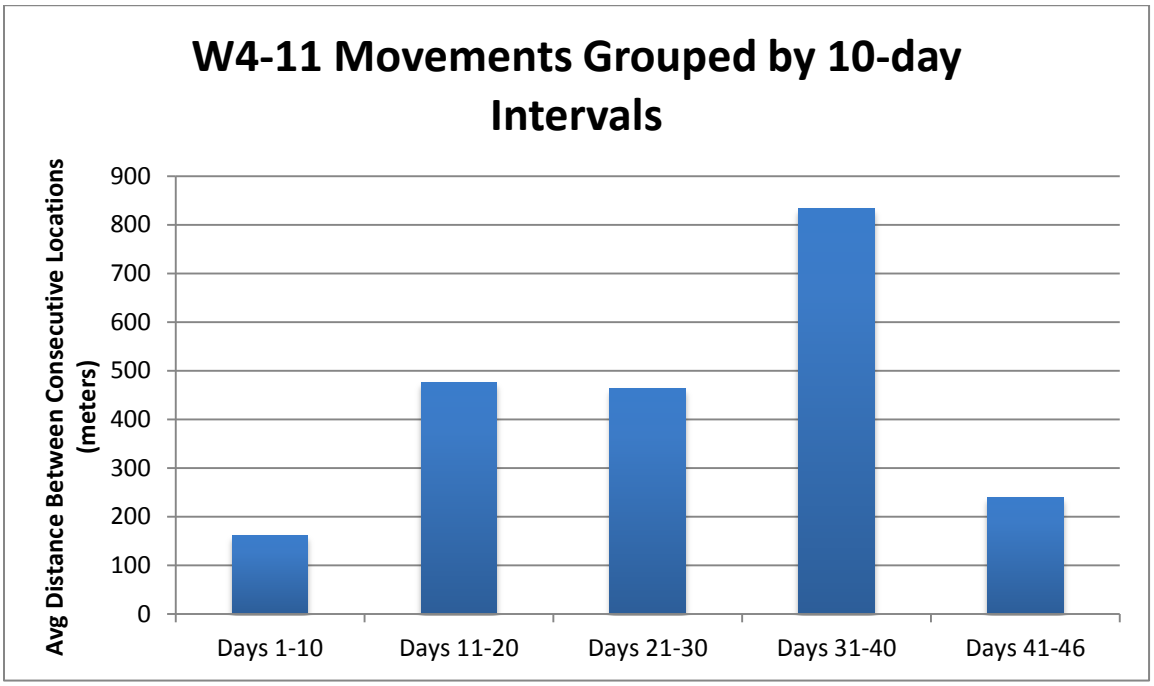
Chick W4-11 hatched to whooping crane pair 2-04/46-07 on approximately May 16. The chick was last seen on June 30 at 0815. Chick mortality was first suspected at 1300 on July 1 when the adults were observed foraging without the chick, and then flew a distance of at least 800 meters. At 1400 on July 1, a search was conducted for the dead chick, in which five people walked parallel to each other through the area where the chick was last seen. The body of the chick (see attached photo) was recovered in reed canary grass on the edge of Rynearson Pool 1 after searching for about thirty minutes. The body was sent to the USGS National Wildlife Heath Center for necropsy (see attached). The necropsy indicated that the chick was killed by a blow that fractured the thoracic vertebral column. The chick's body also showed evidence of predation, including puncture wounds. These results were consistent with a predation event. Based on the monitoring data, the chick died sometime between the morning of June 30 and the morning of July 1, and therefore lived approximately 45 days. Over its lifetime the chick traveled an average distance of 433.6 meters between observations. Within the first ten days of life, the chick traveled an average distance of 161.6 meters between observations. Within the second ten days of life, the chick traveled an average distance of 475.8 meters between observations. Within the third ten days of life, the chick traveled an average distance of 462.8 meters between observations. Within the fourth ten days of life, the chick traveled an average distance of 832.5 meters between observations. Finally, in the last five days of life, the chick traveled an average distance of 238.7 meters between observations. This data may be found in the attached bar graph. The longest distance the chick traveled between any two observations is at least 1437.2 meters. These locations cover an area of approximately 70.7 hectares.

Whooping Crane Chick W4-11


W4-11 Chick Locations
Pool 1 Road
NEST LOCATION
Laske Road
Crane Site 1
MORTALITY SITE
Pool 1
LAST LIVE LOCATION
Legend
0
135
270
540 Meters



* For days with multiple observations, the greatest distance traveled was used for the above graph.



USGS science for a changing world NATIONAL WILDLIFE HEALTH CENTER 6006 Schroeder Road Madison, Wisconsin 53711-6223
608-270-2400 (FAX 608-270-2415)

DIAGNOSTIC SERVICES CASE UPDATE

CASE: 23586 **EPIZOO: INV NUM:** **7/21/2011**

Legal

FINDINGS TO DATE

Submitter: Tom Stehn Aransas NWR P.O. Box 100 1 Wildlife Circle Austwell, TX 77950

Specimen description/identification/Location: Date Submitted: 7/5/2011

ACC	SPECIES	SPECIMEN TYPE	BAND NUMBER	SUBMITTER's ID	COUNTY	STATE
001	Crane, Whooping	CARCASS	W4-11		Juneau	WI

Summary of Physical Characteristics

ACC	SEX	AGE	WEIGHT	BODY CONDITION	POSTMORTEM STATE
	Male	Nestling or suckling	2690 gm	Poor	Poor

Comment:

The whooping crane submitted from Necedah NWR was necropsied 7/19/11. There was extensive evidence of trauma. This nestling male crane had multiple puncture wounds in the left axilla and left lateral thorax and a single puncture wound to the posterior portion of the dorsal head. The right ulna was fractured with missing soft tissue around the fracture. Multiple ribs were fractured and luxated and the proximal thoracic vertebral column was transversely fractured at about T2 T3 which is probably the immediate cause of death.

There appears to be evidence of both predation (with puncture wounds and bite marks) as well as vehicular strike suspected to have caused the fractured thoracic vertebra.

Swabs and various tissue samples have been submitted for further tests. Results are pending. You will be notified of significant results. JLB

Anne E. Ballmann

If you have questions regarding this case, contact:

Anne E. Ballmann , DVM, Ph.D.
Wildlife Disease Specialist
Phone: 608-270-2445 **E-Mail:** aballmann@usgs.gov **Diagnostic findings may not be used for publication without the pathologist's knowledge and consent.**